RAILROAD GAZETTE

FRIDAY, JULY 10, 1896.

CONTENTS

CONTRIBUTIONS:	PAGE.
Compressed Air Motor and Dust	481
Tonnage Rating of Locomotives	481
Fly Switching at the Grand Central	481
ILLUSTRATIONS:	
Locomotive Records of the Illinois Central	481
Illinois Central Improvements at Chicago	483
Temperley Transporters	484
Endless Freight Conveyor of the Texas & Pacific	486
C., R. I. & P. Fast Passenger Locomotives	488
Locomotive Rating and Fuel	488
EDITORIALS:	
Yard Limits	490
Demurrage on Freight Cars in England and America	491
Annual Reports	491
EDITORIAL NOTES	490, 492
New Publications	492
Trade Catalogues	492

GENERAL NEWS:	PAGE.
Locomotive Building	495
Car Building	495
Bridge Building	495
Meetings and Announcements	496
Personals	496
Elections and Appointments	497
Railroad Construction	497
Electric Railroad Construction	497
General Railroad News	498
Electric Railroad News	498
Traffic	498
MISCELLANEOUS:	
Technical	494
Scrap	495
Bridges for Electric Roads	481
Locomotive Works of the Russian-American Manufacturing Co.	485
Education and Apprentices and Shopmen	486
Statistics of the Railroads of the World	488
Science and Engineering	486
Disastrous Rain Storm at Wheeling	493
Railroad Matters in England	493

Contributions.

The Compressed Air Motor and Dust.

NEW YORK, June 15, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

You are quite right in the editorial, criticised by your correspondent, S., June 5 and 12, regarding the use on dusty roads or muddy highways of the compressed air-motor car as at present constructed. Locomotives run away from the dust they raise, even when running with the wind, and there is a large, well-ventilated space below the boiler in which parts subject to wear are disposed high above the track. In the air-motor car all movable parts are crowded close to top of rail, and in a low, covered space are completely shut in by cylindrical bodies of all dimensions which effectually prevent ventilation; moreover, the car does not run away from its own dust. A casing would become so large and angular it could not possibly be made dust-proof, and consequently would only aggravate the objectionable condition.

M.

Tonnage Rating of Locomotives.

CINCINNATI, July 3, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The subject of rating locomotives on tonnage basis seems at this time to be receiving an unusual amount of attention, and from the articles in the local press one would suppose it was an entirely new discovery. It will probably be of interest to your readers to note the following table issued on that subject by the Pittsburgh, Cincinnati & St. Louis Railroad for the line between Pittsburgh and Columbus in the summer of 1881:

Equivalent Loaded Cars for Rating Locomotives.

47,000 coal, coke, rails and grain.	29,500 cattle or Loreee.	41,500 D. D. hogs.	31,300 S. D. hogs.	36,000 D. D. sheep.	28,000 S. D. sheep.	43,000 E. B. grain.	37,500 E. B. merchandise.	29,800 W. B. merchandise or line freight.	Empties.
Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
5	6	6	8	7	8	5	6	8	10
10	12	11	15	13	17	10	12	16	20
12	14	14	18	16	20	12	15	19	24
14	17	16	21	18	24	14	17	22	28
16	19	18	24	21	27	16	20	25	32
18	21	20	27	24	30	18	22	28	36
20	24	23	30	28	34	20	25	32	40
22	26	25	33	29	37	22	27	35	44
24	29	27	36	31	40	25	30	38	48
26	31	29	39	34	44	27	32	41	52
28	34	32	42	37	47	29	35	44	56
30	36	34	45	39	50	31	37	47	60
32	38	35	48	42	54	33	40	50	64
34	40	39	51	44	57	35	42	54	68
36	43	41	54	47	60	37	45	57	72
38	45	43	57	50	64	39	47	60	76
40	48	45	60	52	67	41	50	63	80

Note. Weight of empty car, 18,500 lbs., estimated.
D. D. Double-deck.
S. D. Single-deck.
E. B. Eastbound.
W. B. Westbound.

This is the earliest record so far produced of the application in detail of the so-called tonnage basis to loading freight locomotives. In its details it is not exactly the same as the present application, but the results are reached through the same process.

This only goes to prove that there is after all "nothing new under the sun."

PAN HANDLE.

Fly Switching at the Grand Central Station.

NEW YORK, July 6, 1896.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your last issue, page 473, you made some comments on the system of running trains into the Grand Central Station, at New York, which remind me that Homer sometimes nods. You ask "what will happen, if, just after an engine is cut loose and has got perhaps 150 ft. away from the cars, an air-hose between the engine and tender bursts?" If, before writing those words, you had gone to the Grand Central yard and stood around a while you would have learned two things. First, when the engine is cut off the air is cut off from the tender and is only available for braking on the driving wheels. So there is no danger of a bursting hose between the engine and the tender. Second, you would have learned that after the engine is cut off, a man stands at the door of the forward car with his hand on the conductor's valve inside ready to apply the air-brakes instantly. So you see there is really no mystery in the fact that this practice has been carried on for 25 years without accident.

FLYING SWITCH.

Bridges for Electric Railroads.

BY CHAS. F. STOWELL, C. E.

In the old day of horse cars, almost any bridge that would carry ordinary wagon loads would answer for the street railroad. The advent of electric cars with their greatly increased loads and higher speed rendered a general overhauling of bridges obviously necessary, but this work does not seem always to have received the attention which its importance demanded. Bridge accidents on trolley roads are beginning to be reported, and it is to be feared that the owners of such roads will have to be taught in the hard school of experience before they become convinced that the cheapest is not always in the long run the most economical construction.

It took steam railroads many years to realize that it did not pay to try to skimp on their bridges, but with unimportant exceptions they have all learned it, and now the rule is, at least on roads of any size, to have the bridge periodically examined by trained men; to have their own designs for new structures made by their own experts, either permanently employed or temporarily retained, and to have their work executed under rigid specifications and with close inspection over every portion, from the manufacture of the material to the finished structure. Railroad companies have found that this method of procedure pays not only in the matter of better and safer bridges, to say nothing of getting the full worth of the money they lay out, but, in the event of any possible accident on a bridge, it is found to be a very comfortable thing to be able to demonstrate its exact condition by sources and from testimony entirely independent both of the company itself and of the contractors.

How many trolley companies have done or are doing this? The usual method of obtaining a bridge on a trolley line is either to place the whole thing in the hands of some favored contractor, trusting to his skill and sense of honor to do what is right, or, worse, to get up a general battue of bridge agents, each one making his own plans and specifications, and letting the contract to the one who offers to cover the opening for the least money, after the fashion of ordinary highway bridge lettings and subject to the accompanying evils of pools, poor designs, bad work and rotten steel. The man who would advertise for a horse 5 ft. high and 8 ft. long, letting the seller fill in the rest of the requirements would be looked upon as crazy. But this is precisely in line with what highway commissioners and trolley roads are doing every day, only in their case the result is liable to be more disastrous and costly.

The consequences of this state of affairs are beginning to show themselves in the trolley accidents which happen. Within the last six months the following have been reported:

On Jan. 9 last, the new iron bridge over Tinker's Creek, on the Akron, Bedford & Cleveland road, broke down, killing two men and injuring another. The circumstances have been fully published in the *Railroad Gazette*, and ought to be equally humiliating both to the contractors who built and the company which used the bridge.

On April 7, a new iron bridge over the Clinton River on the Rapid Railroad Company's line at Mt. Clemens, Mich. (a suburb of Detroit), fell with its load, carrying down five men, all of whom fortunately escaped with slight injuries. A newspaper report states that "the owners of the bridge have never felt any fears as to the safety of the structure, as it was constructed by a firm of well-known builders whose very name was a guarantee." But it appears that something more than the reputation of the builder is necessary to hold up a bridge.

On May 26 occurred the disastrous Point Ellice bridge failure at Victoria, B. C., by which 43 lives were lost. It has been generally reported in the engineering press that the cause of this accident was the breaking of a weak and rotten wooden floor beam, but the coroner's jury which investigated it found the cause of the accident to be the breaking of an iron hanger. The jury further says that "the design was poor, the system of construction obsolete, and the contract was not carried out according to the specifications by the contractor. . . . We find that the specifications call for weldless iron, but that the iron work is in almost all cases welded and in many cases of inferior quality, and that the factor of safety provided for in the specifications is an unknown quantity."

On June 14, a stone bridge at Muskegon, Mich., fell, but the cars which were crossing succeeded in reaching solid ground and no one was injured.

Every one of these accidents might have been prevented by the exercise of as much prudence as a man would naturally use in buying a horse if he knew nothing about horses. We shall see how many more cases will be recorded within the next six months.

In ordering a bridge for trolley use the officials of the road are quite likely to underestimate the loads which it will have to carry. I have known them repeatedly to give as the weight of cars the lightest, or at most the average weight, not thinking apparently that it is the heaviest car in use, or the heaviest that may be used at some future time, that is likely to do the mischief. For the load on a car it is common to estimate the seating capacity of a car, though it is notorious that cars with a seating capacity of 25 to 50 are frequently packed with 100 to 150 passengers. In steam railroad work it is common practice to make certain allowances for impact, but in the case of trolley roads this is not generally done, though the necessity for it is the greater. Such bridges are often located in a "hole" between two grades where fast running is natural and where speeds of 25 or 30 miles per hour are not unusual. Moreover the pitching or "teetering" so often noticeable on trolley cars is something unknown on steam cars, and is especially severe on the floor system, throwing, as it does, excessive loads alternately on each axle in rapid succession. But very often it is not the regular or even occasional heavy trolley loads which cause trouble, but the adventitious loads to which almost any road is liable, but which are rarely allowed for. Some roads carry freight, the weight of which should be the governing factor in determining the capacity of the bridges, while a great many run an occasional carload of coal, either for their own or other's use. It was such a load that wrecked the Tinker's Creek bridge, and the Clinton River bridge broke down under three carloads of ballast pushed by a motor. A loaded coal car frequently weighs 88,000 lbs., or 11 tons on each axle, and this is the kind of load which is likely to wreck a good many more trolley bridges before the record is closed.

The quality of the material of which a bridge is built is usually one of the least of the considerations, because it is the one that the purchaser knows least about. It is generally left entirely to the builder, whose object is to make all he can out of the contract and who naturally uses whatever material can be obtained cheapest. Many people delude themselves with the idea that the quality of their steel is of little importance, provided they only get in enough of it. A large amount of poor steel may delay a catastrophe, but will not prevent it. We hear some engineers asserting that as long as steel pulls, bends, elongates and reduces well that is everything necessary, and all the rest may be safely left to the manufacturer. It would be equally consistent to say to a contractor, "I want a bridge which will carry 50 tons. Build it any way you please and out of anything that comes handy, only load it once with 100 tons, and if it does not break down I will take it." They do not realize that out of a lot of 15,000 to 20,000 lbs., one sample weighing two or three pounds, selected, prepared and tested by the manufacturer himself, whose every interest is to have the test come out exactly as he wishes, may possibly not be a fair exemplar of the whole lot; or even if it is, that steel of which a small piece has done certain things once in a laboratory test, may not in large quantities and under the actual conditions of use continue do the same thing indefinitely.

To get good and safe bridges for trolley use requires only that one obtain good designs, good material and good workmanship. And the difference in cost between this and poor designs, scant sections, bad work and rotten material is very slight.

Locomotive Records of the Illinois Central Railroad.

Beginning with Jan. 1, 1895, Mr. Wm. Renshaw, Superintendent of Machinery, of the Illinois Central Railroad, has been using a system whereby the repairs to locomotives and the cost of repairs are regulated in accordance with the number of miles run. The efficiency and and carefulness of engineers is noted by the cost of repairs and supplies charged to locomotives and the relation of such charges to the mileage made.

The repairs to locomotives are divided into three classes, namely: Light, general and thorough. These classes are distinguished one from another in accordance with the cost. Repairs costing up to $500 are termed light, above $500 and up to $2,000 general and above $2,000 thorough. The locomotives are expected to make a certain mileage between general repairs, the mileage depending upon the class of engine.

The assigned mileage for the various classes was determined after a careful study of the road's records and is as follows:

Class of Engine.	Mileage assigned to be made between general repairs.
4-wheel switching	45,000
6-wheel "	55,000
Suburban	70,000
10-wheel	75,000
Mogul { Old type	75,000
Mogul { New type	85,000
Consolidation	60,000
8-wheel old type	100,000
" new types, 1,100 and 1,300 class	110,000
" " " 1,400 class	120,000

According to this plan, after an engine has made its assigned mileage it is put into the shop for general repairs. A complete record is kept in the office of the Su-

perintendent of Machinery of the cost of repairs and supplies to each engine, mileage made each month, together with the condition of the engine. For this purpose there is a locomotive equipment chart in the office of the Superintendent of Machinery shown in Fig. 1.

This chart consists of a large board, 7 ft. 4¼ in. long by 9 ft. ⅝ in. wide, painted black and divided with white lines into numerous sections, each section representing a division of the road. These divisions are subdivided into smaller sections, each subdivision representing a certain class of equipment as follows: Passenger, freight, suburban, switching and construction. One large section of the board is reserved for engines in shops, engines awaiting repairs, engines condemned and engines cut up. This section is subdivided into smaller sections, each one of which represents a shop on the line. All of the sections referred to are figured to suit the number of engines assigned to each particular division and each particular service on that division, and are provided with that number of holes for descriptive buttons.

The descriptive buttons or pegs, shown in Fig. 2 and used in connection with the Equipment Chart, are made of wood and painted black, the face of the button is covered with white paper (this paper is bought, cut to size, and already gummed on the back), on which the following information is printed with black ink: Engine number, size of cylinders, diameter of drivers, diameter of boiler, length and width of firebox, kind of brake equipment and whether equipped with train air signal and for steam heat.

The button being but one inch outside diameter, signs and abbreviations have been used on account of the limited space signs, and such signs and abbreviations are printed on a small explanatory chart, neatly framed and placed near the equipment chart. This explanatory chart appears on the engraving.

The engines on this road are so grouped that the engine number denotes the type to which it belongs.

Mileage cards are held on the board by means of the buttons, and are shown in Fig. 2. These cards are of white cardboard 1 in. wide by 3½ in. long, printed on both sides, and they contain the following information: Engine number, year built, date when taken in shop for repairs, date when taken out of shop, cost of repairs made during that time, and the mileage made each month after leaving the shop.

Condition tags shown in Fig. 2 are also held on the board by the buttons and are placed on top of the mileage cards, covering the engine number and date when built. These tags consist of cardboard of different colors, and measure 1 in. in width by 1 1/16 in. in length, and show the condition of the locomotive based on the mileage that has been made since the last general repairs. Some tags of each color have the word "reserve" printed across the face, and are used when an engine is held as an extra. The colors used, and the condition each color represents are as follows: Blue signifies "Good Condition"; green signifies "Fair Condition"; red signifies "Poor Condition."

Engines are considered in "Good Condition" up to and until they have run three-fourths of full mileage, from three-fourths up to full mileage "Fair Condition," and after full mileage has been made, the engine is considered in "Poor Condition."

A separate locomotive equipment board of suitable size to meet requirements is provided for each Division Master Mechanic's office, and this is subdivided into sections for each class of service, the same as that of the Superintendent of Machinery. Buttons, mileage cards and condition tags are provided, it being a complete duplicate of the larger board, with the exception that it represents only the one division.

In addition to the above, blue prints have been framed and placed in each Master Mechanic's office as well as at each engine-house bulletin board, showing the mileage to be made by each individual engine before going to the shops for general repairs. In addition to the full mileage expected, this sheet contains another column of figures representing three-fourths of full mileage, after making which the engine is considered in fair condition.

At the foot of the sheet appear the following instructions: "The above shows the number of miles each engine is expected to make from *General Repair to General Repair;* it also shows three-fourths the full mileage.

"Engines will be considered in *Good Condition* up to and until they have run three-fourths of full mileage, from three-fourths up to full mileage in fair condition, after full mileage has been made, engine will be considered in *Poor Condition*, and is to be taken into the shop for general repairs as soon as possible thereafter. *All reports* of condition of locomotives on *Weekly Locomotive sheet* to be governed by above.

"For engines that are run in both passenger and freight service *four miles* in *passenger* will be computed as *three miles* in *freight service.*

"*Flues to be removed and boilers cleaned as often as necessary and not to be considered as general repairs.*"

In connection with the above, each engine is provided with a neatly framed card placed in the cab, which states when and where the engine last received general repairs and the number of miles it is expected to run in a certain service before being again taken into the shop.

Mileage.—Inasmuch as engineers and firemen in road service are paid by the trip as per regular schedule provided, and those in switching service are paid by the hour, two separate records are kept in the office of the Division Master Mechanic and two separate blanks are used as trip slips.

Each road engineer is provided with a book of trip slips to be filled out in duplicate, one part remaining in the book as a stub record. This trip slip contains the following information: Name of engineer; name of fireman; number of engine; place of starting; date; hour; place of arrival; date; hour; number of train; remarks; number of tons coal.

At the end of each trip the engineer fills out this slip for himself and fireman and turns it in to the Master Mechanic, who forwards it to the Division Superintendent, who checks and certifies to it from the train sheet and then returns it to the Master Mechanic. A record is then made in the Master Mechanic's office in a book containing columns for the same information as given on the trip slip. From this book engineers' and firemens' wages are computed, also the mileage made by the engine, which goes to make up the performance of locomotives, total mileage, etc.

Engineers and firemen in switching service exclusively use a trip slip containing the following information: Number of engine; name of engineer; name of fireman; time commenced work; stopped work; actual hours worked; remarks. This is sent to the Master Mechanic, who keeps a record of the number of hours worked, date, name of engineer and fireman, and whether the engine was in day or night service. The mileage in switching service is computed on a basis of six miles for each hour worked.

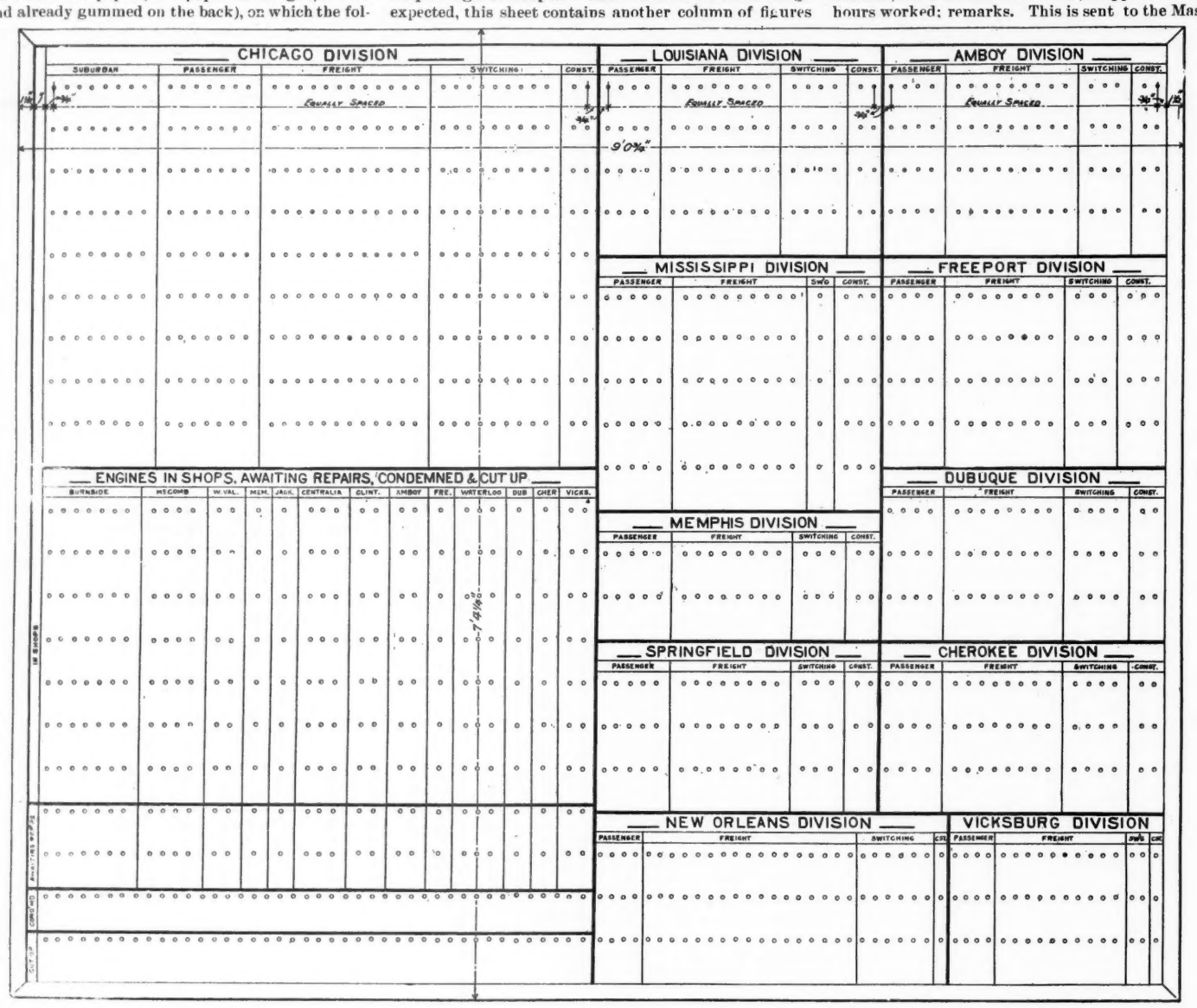


Fig 1.—Equipment Chart—Illinois Central Railroad.

Engineers and firemen in switching service exclusively use a trip slip containing the following information: Number of engine; name of engineer; name of fireman; time commenced work; stopped work; actual hours worked; remarks. This is sent to the Master Mechanic, who keeps a record of the number of hours worked, date, name of engineer and fireman, and whether the engine was in day or night service. The mileage in switching service is computed on a basis of six miles for each hour worked.

Coal.—Each engineer is provided with a book of coal tickets, which tickets are in triplicate and are of different colors. Pink tickets call for one ton of coal, yellow tickets for two tons, blue tickets for three tons and white tickets for four tons; all are provided with space for engine number, the place and date of receiving coal, together with the name of the engineer. The engineer fills out all three parts of the ticket, paying one part to the coal man at the chutes, who in turn forwards it to the fuel department; the second part is forwarded by the engineer with his trip-slip to the Division Master Mechanic and is checked against the fuel statement made by the fuel department, and the third, or stub, is retained by the engineer. The fuel tickets are numbered consecutively in the book, and each book has its own individual number which appears on each ticket, thereby avoiding confusion in checking.

Tools and Equipment.—Requisitions are made by the engineer on the store keeper for tools and equipment required on the engine. These requisition blanks are furnished to the engineer in book form and are made in duplicate and approved by the foreman in charge, the

engineer retaining the stub. The store keeper charges the material furnished on these requisitions to both the engine and engineer, and an inventory is made each month by the engineer on a special blank, showing what tools are on the engine and what their condition is, as well as what was on the engine the first of the previous month and what was issued during the month.

Oil and Waste.—Each engineer is provided with blanks in book form to be used in ordering supplies of oil and waste direct from the store keeper. This blank provides for the engine number, kind of service, pints of valve, engine, signal and car oil and pounds of waste. This blank is made out in duplicate, the engineer retaining the stub. All charges are made against both engine and engineer.

Repairs.—Repairs to locomotives and cost of repairs are reported by each Division Master Mechanic to the Superintendent of Machinery on a special blank showing the date when taken in for repairs and the date when completed, the nature of repairs, the cost of labor and material and the amount of repairs due to accident, if any. This blank covers all the principal parts of the engine and is filled in and forwarded to the Superintendent of Machinery as soon as the repairs have been completed. All materials and labor are charged to the engine number.

Locomotive Performance Sheet.—Each Division Master Mechanic reports to the office of the Superintendent of Machinery each month on the locomotive performance sheet. This report gives the number of the engine, name of the engineer, the mileage made in all services, the amount and cost of all supplies and fuel used, the cost of labor and materials used in repairs, the wages of engineers and firemen and cost of cleaning engines, as well as the cost per mile run, for repairs, supplies, fuel, wages, cleaning and the grand total cost; also the number of miles run per pint of valve, engine and all oils and also the number of miles run per ton of coal. This sheet is compiled from the engineers' trip records, the storekeeper's record of distribution of supplies, record of repairs, wages paid and fuel consumed, all of which are in the office of the Master Mechanic. From these division performance sheets a summary is made each month in the office of the Superintendent of Machinery, which contains the same information for each division and also for the entire road as is shown for each separate division on the sheet already described

In addition to this is shown for each division and for the entire road the passenger and freight-car mileage, the average passenger cars hauled per passenger-engine mile and the same for freight, also the cost per mile for repairing passenger and freight cars. A comparative statement at the bottom of the sheet shows the totals in each item for the entire road for the current month and for the same month of the previous year, with the increase or decrease and the percentage of same.

A full set of blue prints, made from division sheets, as well as a summary is furnished to each of the Master Mechanics.

Supplies Furnished Engines.—A record of the engineers' mileage and comparison of same with cost of tools, supplies, etc., furnished engines in their charge, is kept in the office of the Superintendent of Machinery, and this information is compiled from the monthly report sent in by the Master Mechanics. For this report a form is used, divided into numerous columns, each article having a column. In the first column appears the name of the engineer, then comes the number of miles run, number of the engine, names of the various tools and supplies, the total cost and the cost per mile.

Condition of Power.—The mileage made by locomotives each month is taken from the division performance sheets and entered on the mileage cards on the equipment chart. If the engine has had general repairs and is about to leave the shop, the cost of such repairs is entered on the same card, and the date when it was taken out of the shop is also noted; or, if the engine is reported as having been taken into the shop, that date is filled in. The condition tags on the equipment chart are changed in accordance with the mileage made, and the report sent in weekly by the Master Mechanics; the blank used shows the engine number, the condition of the engine, how and where employed, together with the name of the engineer. Engines transferred from one division to another are shown on this report. A weekly statement is compiled from these division reports in the office of the Superintendent of Machinery containing the same information for the entire road.

Each month a report is made out in the office of the Superintendent of Machinery, showing the mileage made by each engine, as well as the number of miles assigned to each, the engines under repairs and those which have exceeded their assigned mileage, and from this information is figured the condition of power as compared with the previous month and on a percentage basis. From this report it is the intention to make a yearly report showing the variation in condition of power for each of the 12 months, as well as the total loss or gain for the year. A preliminary report for seven months is shown on the table and this shows that there has been a loss in condition of power on the Illinois Central Railroad of one per cent. and a gain on the Yazoo & Mississippi Valley Railroad of one per cent. for the seven months.

To be more explicit as to the exact meaning of a one per cent. gain or loss, take the Illinois Central Railroad alone. One per cent. of the aggregate mileage to be made by all engines between General Repairs would be 502,600 miles, and this divided by the average mileage to be made by each engine would equal $6\frac{35}{165}$; this in the form of a loss would signify that there are $6\frac{35}{165}$ engines in service that should have been through the shop during the seven months, but have not been, therefore, the loss of one per cent. in condition.

We are indebted to Mr. Wm. Renshaw, Superintendent of Machinery, for the information given above.

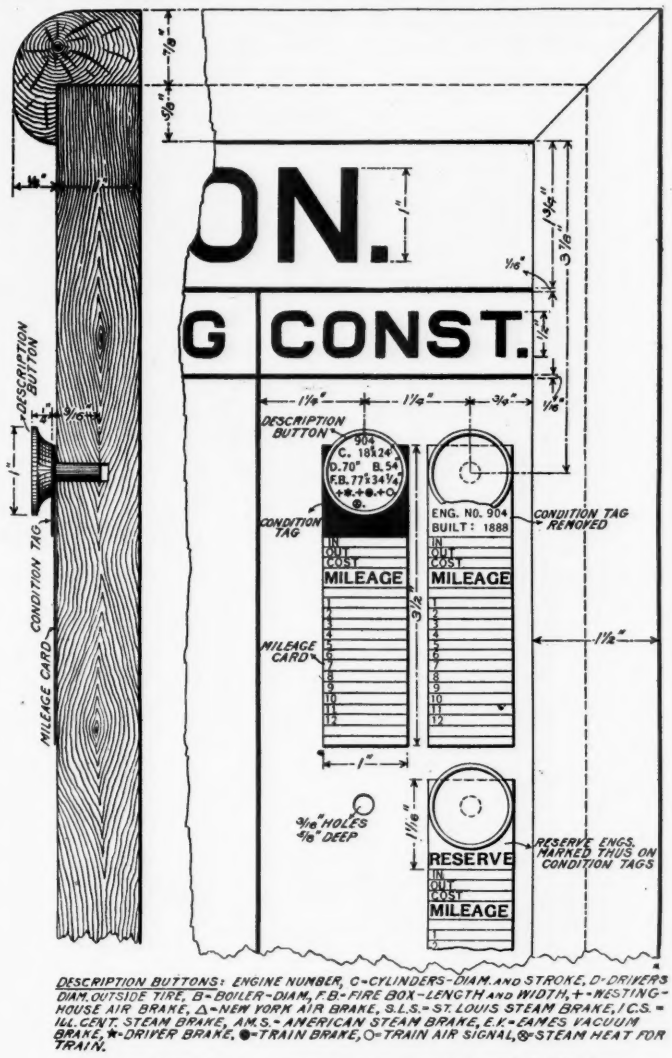

ON.
G CONST.
DESCRIPTION BUTTON
CONDITION TAG
MILEAGE CARD
904
C. 18½24
D. 70" B. 54
F.B. 77½34¼
ENG. NO. 904
BUILT: 1888
CONDITION TAG REMOVED
IN
OUT
COST
MILEAGE
3/16" HOLES 1/16" DEEP
RESERVE
RESERVE ENGS. MARKED THUS ON CONDITION TAGS
DESCRIPTION BUTTONS: ENGINE NUMBER, C-CYLINDERS-DIAM. AND STROKE, D-DRIVERS DIAM. OUTSIDE TIRE, B-BOILER-DIAM, F.B-FIRE BOX-LENGTH AND WIDTH, +-WESTINGHOUSE AIR BRAKE, Δ-NEW YORK AIR BRAKE, S.L.S.-ST. LOUIS STEAM BRAKE, I.C.S.-ILL. CENT. STEAM BRAKE, A.M.S.-AMERICAN STEAM BRAKE, E.K-EAMES VACUUM BRAKE, ★-DRIVER BRAKE, ●-TRAIN BRAKE, ○-TRAIN AIR SIGNAL, ⊗-STEAM HEAT FOR TRAIN.

Fig. 2.—Corner of Equipment Chart—Illinois Central Railroad.

ILLINOIS CENTRAL RAILROAD COMPANY.—COMPARATIVE CONDITION OF POWER ON MILEAGE PERCENTAGE BASIS, FROM JANUARY 1, 1895, TO JULY 31, 1895.

Road.	Month.	Total engines.	Aggregate mileage. Total engines.	Average miles assigned per engine.	Total mileage made since last general repairs.	Average miles since last general repairs.	Per cent. of miles made.	Per cent. of miles to make.	Compared with previous month. Gain.	Loss.
							Per cent.	Per cent.		
I. C. R. R....	January	610	50,260,000	82,393	22,462,044	36,821	45	55	None	None
Y. & M. V..	"	105	8,700,000	82,857	5,641,399	53,727	65	35	2%	.....
I. C. R. R....	February	610	50,260,000	82,393	21,986,598	36,043	44	56	1%	.....
Y. & M. V..	"	105	8,700,000	82,857	5.655,991	53,819	65	35	None	None
I. C. R. R..	March	610	50,260,000	82,393	22,522,575	36,922	45	55	.....	1%
Y. & M. V..	"	105	8,700,000	82,857	5,606,576	54,348	64	36	1%	.....
I. C. R. R. ..	April	610	50,260,000	82,393	22,239,272	36,458	44	56	1%	.....
Y. & M. V..	"	105	8,700,000	82,857	5,834,240	55,564	67	33	.....	3%
I. C. R. R...	May	610	50,260,000	82,393	22,042,335	36,135	44	56	None	None
Y. & M. V..	"	105	8,700,000	82,857	5,506,365	52,441	63	37	1%	.....
I. C. R. R....	June	610	50,260,000	82,393	22,478.886	36.849	45	55	.....	1%
Y. & M. V..	"	105	8,700,000	82,857	5,404,437	51,471	65	35	.....	2%
I. C. R. R....	July	610	50,260,000	82,393	22,919,489	37,573	46	54	.....	1%
Y. & M. V..	"	105	8,700,000	82,857	5,340,791	50,865	64	36	1%	.....

Variation in Illinois Central Railroad engines for the seven months, 1 per cent. loss.
" " Yazoo & Mississippi Valley " " " " " 1 " gain.

NOTE.—A loss of 1 per cent. on Illinois Central Railroad engines equals 502,600 miles or $6\frac{35}{165}$ engines short for service.
A gain of 1 per cent. on Yazoo & Mississippi Valley engines equals 87,000 miles or $1\frac{64}{165}$ engines over for service.

The Illinois Central Railroad Improvements at Chicago.

When the plans agreed upon by the city of Chicago and the Illinois Central Railroad Company for the Lake Front Park improvements at the Chicago terminal yards of the Illinois Central road shall have been fully executed, the tracks of the Central at that point will run, at a depth of 15.8 ft., through the heart of one of the most beautiful parks of the world. The plan and scope of the work are comprehensive and calculated to serve, alike, the ends of adornment and utility. The work of depressing the tracks and filling the park to a grade that shall remove from view the trains therein is the outcome of the much-discussed question of ownership upon the lake shore at this point.

Extending over a number of years, up to Sept. 24, 1888, a triangular legal fight over titles was waged by the people of the State of Illinois, the city of Chicago and the Illinois Central Railroad Company. The subject matter of contention was the riparian rights of each of the parties to the litigation upon what is known in Chicago as the Lake Front. This is that portion of the city water-front which lies between the north line of Randolph street, extended east to the lake, and the south line of Park Row in like manner extended. Quoting from minutes of the City Council of Chicago, in session on Oct. 21, 1895, and from the ordinance as passed:

"The Circuit Court of the United States for the Northern District of Illinois, in the suit of the people of the state of Illinois, complainants against the city of Chicago and the Illinois Central Railroad Company, defendants, decided that, excepting the rights of the Illinois Central Railroad Company, as defined in the decree of the court, the fee of all the public lands in the city of Chicago, lying east of Michigan avenue, and between the north line of Randolph street, extended to Lake Michigan, and the north line of Block twenty-three, extended to the lake, in Fractional Section Fifteen, addition to Chicago, including the grounds upon which rest the tracks and breakwater, constructed by the Illinois Central Railroad Company, is in the City of Chicago in trust for public use, and, that as riparian owner of the said lands the city is restricted in its occupancy and disposal of the same for public use, only by such rightful authority as may be exercised by the state or general government, by legislation."

This decree, being affirmed by the Supreme Court of the United States, practically resolved the matter into a question of supremacy, upon the debated ground, between the City of Chicago and the Illinois Central Railroad Company. On October 21, 1895, the ordinance above mentioned, looking toward the final disposition of this question of title, was passed by the City Council of Chicago. Mutual concessions were proposed and were subsequently agreed upon by the Illinois Central Company.

By the terms of a contract entered into by the Common Council of the city of Chicago and the Illinois Central Railroad Company, on March 28, 1853, the Illinois Central Railroad Company was entitled to "enter upon and use in perpetuity, for its said line of road, and for works necessary to protect the same from the lake, a width of 300 ft., from the southern boundary of said public ground (the Lake Front Park), near Twelfth street, to the northern line of Randolph street." This grant has been utilized only in part, in its full width, at the extreme yard ends, as shown in the small sketch map which appears with this article, and shows in detail the plan of adjustment as adopted. With the exception of that land which is already embodied in the spread at either end of the yard lines, the Illinois Central Company releases its claim upon the balance of the 300-ft. grant, and is now possessed throughout the yards defined of a right of way 200 ft. wide, its present enlargements at either end, before mentioned, and those additions hereafter referred to and enumerated in the plan of adjustment shown.

The Illinois Central Company yields title, also, to submerged land-strips marked "C," containing 2.8 acres, "D" containing 4.66 acres, small fillings marked "W," "Y" and "Z," containing respectively 0.25, 0.17 and 0.17 acres, and to the submerged strip marked "Yacht Harbor," which will serve the double purpose of an approach to the railroad pier, marked "Pier No. 1" and a waterway for small craft entering from the lake into the harbor herein described.

The city, therefore, acquires a total area of 8.05 acres, aside from the new limitation of the main right of way.

The city grants, in return, title to that land submerged at "A," 6.67 acres, and at "B" 1.26 acres; in total 7.93 acres, showing a net gain to the city of 0.12 of an acre.

The Illinois Central Company is assured the right to maintain upon its grounds, east of the general passenger station and south of Park Row, all buildings that are now standing on this territory. They may also erect and maintain upon their right of way any buildings they may deem necessary, between the north line of Randolph street and the southern boundary of the Lake Park, provided that the tops of none of these buildings shall exceed in height the tops of the retaining walls and parapets thereon (26 ft. above city datum) with which their right of way will be flanked at either side. If buildings are erected at street intersections with the right of way within the park, then the height of buildings shall not exceed the height of the floor line of the viaduct or footway there erected.

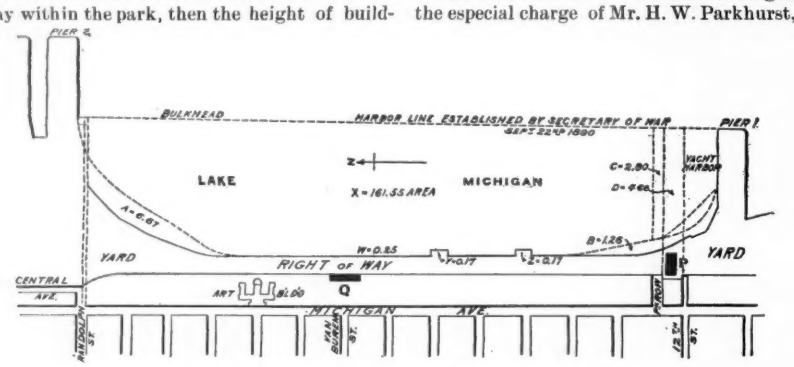


Fig. 1.—Plan of Adjustment of Title as Adopted.

P, General Passenger Station; *Q*, Van Buren Street Suburban Station Site, 300 ft. × 59 ft.

The Illinois Central is continued in its right to possess a suburban station site, 50 ft. × 300 ft. at the foot of Van Buren street, extended, and to erect thereon a station that shall conform to requirements as agreed upon with the municipal authorities. The right is also given to the railroad company to place all necessary conduits or tile needed to insure the proper drainage of its right of way and to connect the same with the nearest city sewer, or to discharge into the lake.

With these grants, the title of the Illinois Central Railroad Company is made absolute to all lands and rights as here rehearsed. It is required in return by the city that the filling of the Lake Front Park, west of the Illinois Central right of way, and the filling of all submerged grants to the railroad company be performed by the Illinois Central Railroad Company; that a retaining wall of rubble masonry, the top of which shall be 22 ft. above Chicago city datum, shall be built upon both sides of the company's right of way throughout the length of the grounds described; the walls to be of sufficient strength to withstand the pressure of a back-filling of earth, which shall rise to their tops and constitute the terraced body of the new Lake Park; these retaining walls to be surmounted by a parapet, suited to guard the depression in which the tracks shall lie. Upon the harbor line established by the Secretary of War, on Sept. 22, 1890, there shall be driven, by the railroad company, a double line of piles that will bear dredging to a depth of 20 ft., and when fortified with the customary planking and filling, it shall be fit to withstand the earth pressure of the park fill; the inner harbor fill to be made by the city.

Between the newly established east park-line and the outer breakwater, not shown in the illustration, there will remain an ample ship-channel or harbor, to which suitable approaches shall be made upon the newly filled land.

It is also agreed that the tracks of the Illinois Central, 14 in number, lying within the district involved, shall be depressed to a point not to exceed 6 ft. above city datum, at the base of the rails of the east and the west tracks. Between these tracks, the intermediate tracks, leads and switches may be crowned in such manner as to afford the necessary drainage to the right of way, and may not exceed an elevation of 7 ft. above city datum at the base of the rails.

This condition will necessitate an average depression throughout the yards of 4 ft. below the present grade. The maximum depression, after being maintained in full from a line 200 ft. north of the north line of Peck Court to the north line of Monroe street, is then merged into the gradient necessary to connect with the original grade as maintained at Randolph street and Twelfth street yards.

The filling of the park and the harbor to the height stated will effectually exclude from the street view the movement of trains on the lake front, as contemplated. The tracks will be bridged with ornamental viaducts, built of steel and asphaltic concrete and terra-cotta trimmings, at points designated by the city.

There are to be built not more than four viaducts with a carriageway and two footways each at streets within the park's length. Three independent footways will be built at other points for the present use, and a footway to be built in the line of any remaining street between Randolph street and Lake Park Place (Park Row) at the discretion of the Commissioner of Public Works of the city of Chicago.

These matters having been agreed upon the work was begun by the railroad company on Nov. 1, 1895. The J. L. Fulton Company, contractors, of Chicago, received contract for building the retaining walls along the right-of-way, and they are now engaged on the construction of the west wall and the piers for viaduct supports.

From the nature of the work involved, practically the entire field of railroad engineering is being covered by the engineering department of the Illinois Central Company at this time.

The work is thoroughly systematized and is apportioned to the several heads of the department of engineering, of which Mr. J. F. Wallace is Chief Engineer. The maintenance of way, establishment of tracks and grades and other matters of like import are under Mr. David Sloan, Assistant Chief Engineer. The marine and bridge work and also the viaduct and bridge designing are the especial charge of Mr. H. W. Parkhurst, Engineer of Bridges. The local field at Chicago, including track depression, construction of bulkheads and retaining walls and the filling of the old park, is in the immediate charge of H. U. Wallace, Resident Engineer for the Illinois Central at Chicago. The work is progressing in a very gratifying manner. The constructive features of this extensive undertaking will be made the subject of a later article in the *Railroad Gazette*.

The Temperley Transporter.

The Temperley transporter is a new form of hoisting and conveying apparatus, invented by Joseph Temperley, of London, England, the exclusive American rights of which have recently been acquired by the Lidgerwood Manufacturing Company, New York City.

The transporter employs an I-shaped beam for a trackway, along which the load hoisted is carried by a carriage in either direction to the point desired. The beam is suspended horizontally or at a slight incline, and is provided along its bottom flange with a series of stops, at any of which the carriage may be arrested and the load raised or lowered. These stops may be set as near one another as desired; 5 ft. is the usual standard. The beam or trackway may be of any desired length and arranged together with its supports in a variety of ways to suit the exigencies of the case.

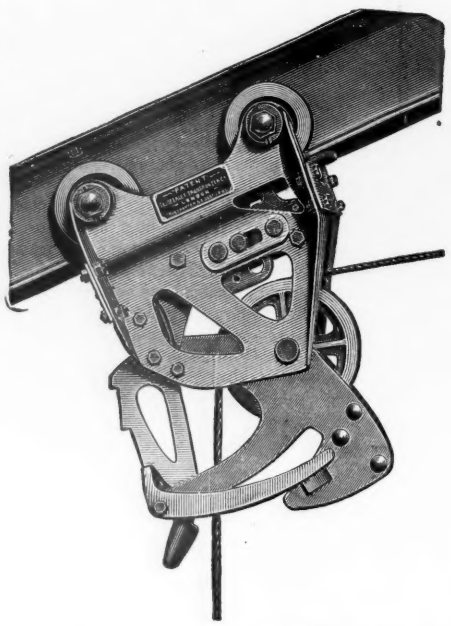


Fig. 1.—Carriage of Temperley Transporter.

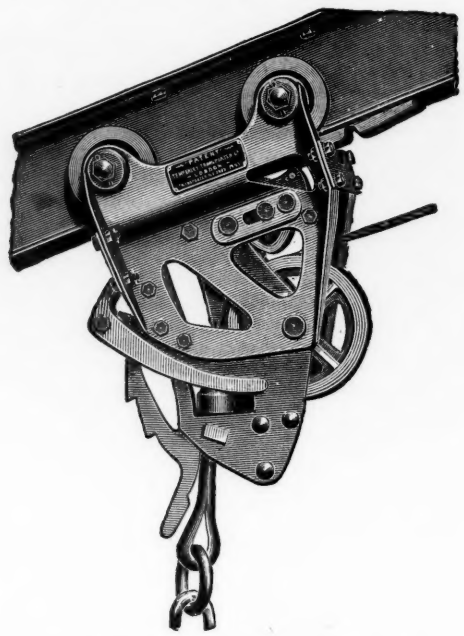


Fig. 2.—Carriage of Temperley Transporter.

A special feature of the Temperley transporter is the form of traveling carriage employed, two views of which are shown in Figs. 1 and 2. It consists of two steel side plates carrying four wheels, by which it travels back and forth on the beam, also the hoisting rope pulley and the disengaging and carrying apparatus. Two cams, one simple the other compound, are so arranged that the former prevents the disengaging portion of the carriage from releasing the load while it is being transported along the beam, and the latter prevents the movement of the carriage along the beam while the load is being raised or lowered. These cams are so fitted that only one of them can perform its function at any one time.

The movement of the compound cam is effected by means of a toggle which engages with the stops on the beam; the movement of the single cam is effected by the movement of the suspender or hook which carries the load.

All operations of the transporter are effected by one working rope. Starting with the carriage at the foot of the inclined beam and drawing in the single rope the load is hoisted vertically to the carriage. The ball on the rope operates to rotate the suspender hook until it is in a condition to suspend the load. The upper part of the suspender operates the pair of cams, whose movements are interlocking. The instant after the suspender hook is in a safe position under the ball the cams move, releasing the carriage from the beam. A further inhauling motion on the hoisting rope carries the carriage up past the various stops. When it is desired to lower at a particular stop it is only required that the stop shall be passed, and the rope then paid out, when the carriage will fall down until it reaches the stop, where it will be locked into it, and the load released from the carriage, and lowered.

After delivering this load, or receiving one, as the case may be, the rope is again hauled in, the same action gone through with and the carriage is in a position to pass down by all the various stops in its path. When the carriage reaches the last stop on the beam, the load is detached, and it is free to descend.

If however, it is desired to have the carriage stop at any intermediate point, it is only necessary that the stop be passed and the carriage hauled up enough in an upward direction to pass the stop; then, by lowering, the carriage is fixed, and the load released at that particular point

The beam is usually set at an angle so that the carriage travels in one direction by gravity. If, however circumstances do not admit of the inclined beam, then a counter-weight rope is attached to the rear of the carriage, and the carriage is pulled back by the falling counter weight. Fig. 1 shows the carriage locked to the suspended beam and the load being raised or lowered. Fig. 2 shows the load locked to the carriage, which is free to travel along the beam in either direction.

The great outreach of the transporter makes it particularly well suited for certain kinds of work, especially along rivers where wharves are not provided.

It has been put to a number of uses in England, notably for handling coal, both on wharves and vessels, also for stacking timber, discharging cargo, handling ice, coke, baled hay and cotton and many other kinds of material which are conveniently handled in packages. It has also been used for coaling warships at sea with great success, having been supplied to the British Admiralty, also to the German, Austrian, French, Italian and Russian governments for that purpose.

Fig. 3 shows an installation where, instead of I-beam, a steel tube is used with a trackway secured underneath, which answers the same purpose. This was erected at the Midland Coal Company's wharf, at Woolwich, England, and has a lifting capacity of 2,000 lbs. The beam, or spar, is 85 ft. long, and is capable of traveling sidewise 40 ft. The duty per hour is 40 tons. The rail on which the carriage runs is made of channel iron, fitted with stops at intervals of five feet. The carriage can be stopped at any one of the stops along this rail, and the load raised or lowered. When the load is being raised or lowered the carriage is fixed rigidly to the track, and when it is traveling the load is locked to the carriage, so it is impossible to lower it. These various movements are interlocked, so that it is practically impossible for any premature action on the part of the carriage to take place. The steel tube, or spar, is supported at frequent

intervals by a series of wire rope guys, which terminate at their upper ends in a single ring, and the whole thing can be slung on an ordinary derrick or crane. The illustration shows it supported on a track, and the whole apparatus is therefore capable of sidewise motion so far as the length of the supporting beam will permit, and thus a large area can be covered. The ends of these spars are fixed in position by guys. The use of this transporter has dispensed with the services of six men formerly employed in handling coal as delivered by an ordinary crane.

The Locomotive Works of the Russian-American Manufacturing Company.

We have had occasion to note from time to time in the last three or four years the various steps in the project of an American company to bui'd locomotive works in Russia. A few weeks ago we announced that the contracts for the machinery and tools were being let in this country. We are now able to give further information about the plant.

The works will be erected near Nijni-Novgorod, a historic town of Russia, northeast of Moscow. The site of the new plant adjoins the extensive Sormovo works, in connection with which the locomotive shops will be operated. The Sormovo works takes its name from a village on the banks of the Volga River about 4½ miles from Nijni-Novgorod. The locomotive establishment is to consist of five main buildings, which are now going up. These are an erecting and machine shop, 110 ft. × 600 ft.; a wheel shop, 120 ft. × 240 ft.; a foundry, 135 ft. × 450 ft.; a boiler shop, 120 ft. × 275 ft., and a blacksmith and hammer shop, 110 ft. × 120 ft. The plans also contemplate a paint shop, a storehouse and an office building. These, however, will not be put up at present. The erecting and machine shops will occupy the largest building, the erecting department taking up 63½ ft. of the width and the machine shop 46½ ft., both shops running the entire length of the building. The machine shop will have a gallery for half the length of the structure, and will thus have 42,000 sq. ft. of floor space. The tracks in the erecting shop will run lengthwise of the building. In the wheel shop the axles, wheels and crank pins will be finished and the grinding and copper smithing also will be done. The Sormovo works has some machinery that can be used in locomotive building. The most important is a hydraulic forging press of 1 200 tons capacity built by Tannett, Walker & Co., of Leeds, Eng. The possession of this great forging press in an existing building has permitted the building of a rather small blacksmith shop.

The main structures will be of brick and steel. The brick is of local make, but the steel for the roof trusses, columns, etc., is rolled in Germany and finished for erection at Sormovo. The general plans for the building were prepared by Mr. W. F. Dixon, the Engineer of the new works. The detailed dimensions were worked out in the office of Julian Kennedy, at Pittsburgh. The plans were made after a careful study of the arrangement and design of the important locomotive shops in this country and in Europe and embody the conclusions of that study, but the plans have no particularly novel features. The erection of the main buildings was begun in May last and it is hoped to have all the structures under roof this fall. Unless there is some unforeseen delay in finishing the building the shops will be started up about the middle of next spring.

The new plant will have a capacity for building 150 locomotives a year. It will employ about 1,000 men. The company will have the experienced workmen of the Sormovo works to draw from to a certain extent and the labor question seems to be a simple one.

The tools and machinery will all be of American make. The contracts have now been let, and the machinery will be shipped to Russia from Philadelphia early in September. The value of the machinery and tools ordered for the works is not much less than $510,000. The following is believed to be a complete list of the firms receiving orders:

Betts Machine Co., Wilmington, Del., 15 planing machines, running from 36 in. square to 48 in. square, various lengths, and the larger sizes with four heads; two on the crossrail and one on each upright; six slotting machines, from 12 in. to 15 in. in size; one horizontal boring and drilling machine, and one heavy 50-in. upright drilling machine.

Brown & Sharpe Manufacturing Co., Providence, R. I.

Bullard Machine Tool Co., Bridgeport, Conn., two 37-in. boring and turning mills and a number of turret machines.

D. Saunders' Sons, Yonkers, N. Y., for two pipe cutting and threading machines, one to cut and thread ⅛-in. to 2 in. pipe, the other 1-in. to 4-in. The machines will be the firm's latest patterns with improvements, and will have adjustable expanding die heads.

E. Harrington, Son & Co., Philadelphia.

Heine Boiler Co., St. Louis.

Hilles & Jones Co., Wilmington, Del.

Morgan Engineering Co., Alliance, O., for steam hammers, etc.

Morse Twist Drill Co., New Bedford, Mass., drills, reamers, sockets, taps, etc.

National Machinery Co., Tiffin, O.

Newton Machine Tool Works, Philadelphia, for heavy milling machines, cold saw cutting-off machines, boring machines, etc.

Niles Tool Works, Hamilton, O.

Pawtucket Manufacturing Co., Pawtucket, R. I.

Payne Engine Co., Elmira, N. Y., eight "improved Payne engines," of 30 H. P. each. These engines are of simple center crank, high speed, automatic type, with cylinders 8 in. × 10 in.

Pedrick & Ayer, Philadelphia, Richards open side planers and shapers and several pneumatic appliances.

Pencoyd Iron Works, Philadelphia, for a turn-table center.

Pond Machine Tool Co., Plainfield, N. J.

Powell Planer Co., Worcester, Mass.

Prentice Brothers, Worcester, Mass., one universal radial drill and one special machine for the automatic drilling of telltale holes in staybolts. The latter machine is a two-spindle drill, entirely automatic, except that the operator has to keep it supplied with work, so that it will drill the holes as fast as the bolts can be put in and taken out.

Rand Drill Co., New York, for air compressors.

Riehle Bros. Testing Machine Co., Philadelphia, one 100,000-lb. automatic and autographic vertical screw power testing machine, with screw beam, graduated in kilograms, and one double-headed specimen miller for preparing test specimens.

Tabor Mfg. Co., Elizabeth, N. J.

Warner & Swasey, Cleveland, for brass working machinery.

Whiting Foundry Equipment Co., Chicago, for cupolas.

Wilbraham-Baker Blower Co., Philadelphia.

William Sellers & Co., Inc., Philadelphia, for cranes.

Electricity and compressed air will be largely used for power to run the shops. The buildings will be piped so that compressed air can be used for the hoists, portable tools, and wherever it is advantageous. The Sellers cranes will all be electrically driven, and Westinghouse electric motors will be used to operate the heavy machinery.

The plant will be under the direct management of Mr. Dixon. The Assisant Engineer, the foremen of the various departments and a number of draftsmen will be Americans. About a dozen men in all will be engaged in this country for these positions. Mr. Dixon was for six years chief draftsman of the Rogers Locomotive Works. He resigned in September, 1895, and has since been engaged in getting the buildings for the new works under way, selecting machinery and in other arrangements preliminary to starting up the shops. He has spent a good deal of the last year in Russia, and has made three trips to that country. He has been in this country for several months past, but expects to leave this month for Russia to remain there permanently.

The project for the erection of a locomotive building plant in Russia by an American company goes back to 1893, and we believe originated directly in the remarks of some Russian railroad officers who had seen the locomotive exhibits at the World's Fair and urged the establishment of locomotive works in Russia equipped with American tools. In 1894 Mr. E. M. Herr, now Assistant Superintendent of Motive Power and Machinery of the Chicago & Northwestern, visited Russia at the request of those interested in the plan, to study the conditions under which such an enterprise could be carried on. He made a favorable report and the plan has since advanced step by step to its present stage. The company controlling the new plant is the Russian-American Manufacturing Co., incorporated in this country with substantial financial support in New York, Philadelphia, Boston and Pittsburgh. The President is Mr. H. H. Hollister, of New York City, and the Vice-President Mr. E. D. Smith, of Philadelphia; the Treasurer is Mr. H. D. Babcock, of New York City. Mr. Smith is now in Russia on the business of the company.

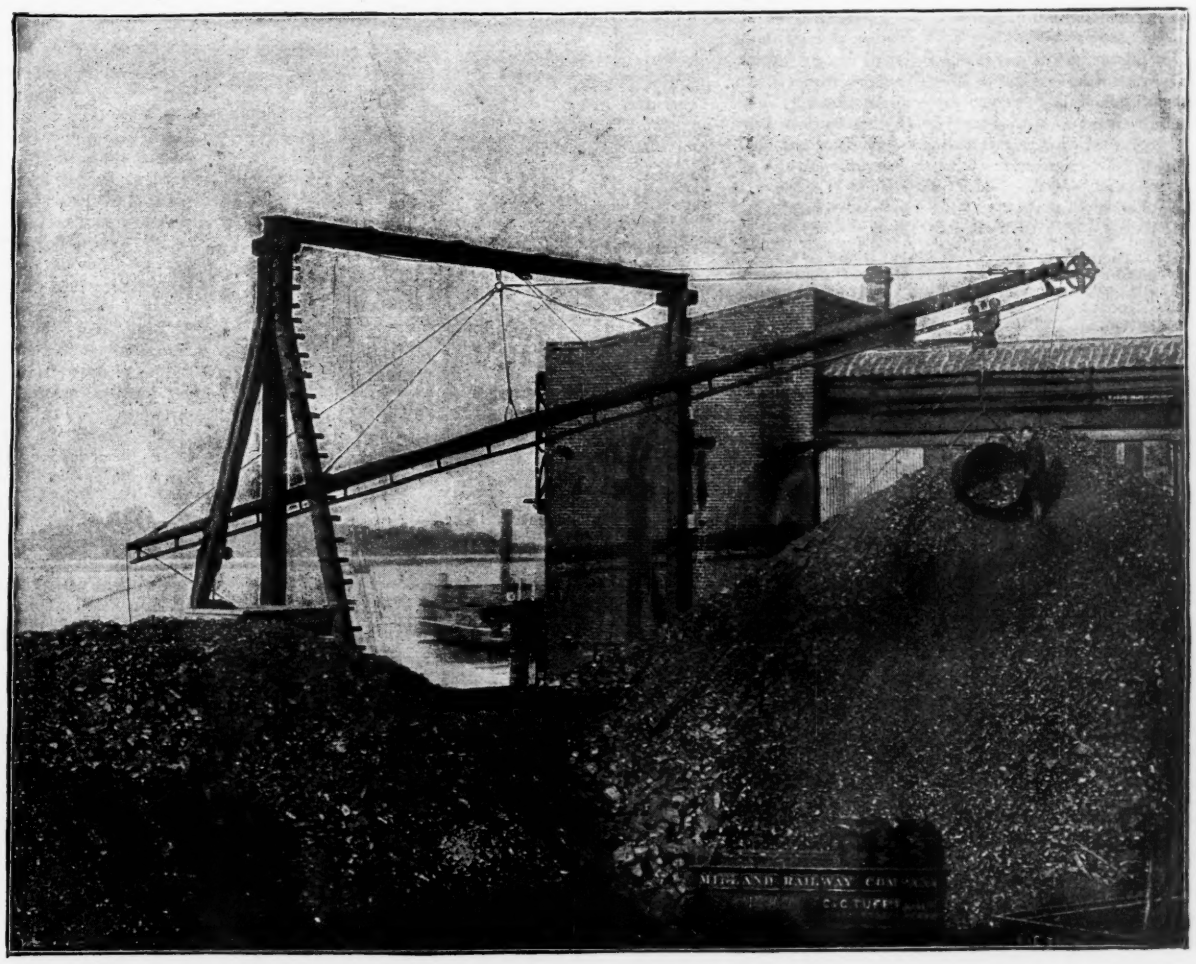


Fig. 3.—Temperley Transporter at the Midland Coal Company's Wharf—Woolwich.

The officers of the Russian-American Manufacturing Co. proposed to complete and operate the locomotive works as an independent concern, but when the plans were quite well advanced the managers of the Sormovo works, already referred to, proposed that the new plant be made a department of that works. This was finally agreed to, the Sormovo Company contributing a portion of the capital. The new plant therefore will be operated in co-operation with those works. The alliance is of advantage in a number of ways. The officers of the locomotive works have the benefit of the experience of the older company in Russian business affairs and will be aided by its wide reputation. On the other hand, the Sormovo Co. will profit by American experience in locomotive building, with shops built and tools and machinery selected for that special purpose. The Sormovo Company has been in existence 40 years and employs 5,000 men. It builds steamboats, marine boilers and engines, railroad passenger and freight cars and heavy machinery.

Russia now has five establishments which build locomotives. Most of them are of small capacity, but one has perhaps as great a capacity as the new works at

Nijni-Novgorod. None of these existing plants, however, are properly locomotive building shops. Locomotives are built simply as one class of a great variety of machinery. The American Company's plant will be given up entirely to building locomotives.

The enterprise is entirely a private one. The company has no Government concession and no guarantee of orders, but the proprietors have no doubt that the requirements of the Russian railroads assure the continuous running of the plant on profitable orders. The annual capacity of existing locomotive works in Russia for turning out locomotives is so much below the requirements of the railroads that large orders are regularly given to German and English builders. The large contracts of the Baldwin Locomotive Works are familiar. Altogether that company has received orders for 134 locomotives for the Russian railroads since last September. The firm is now engaged on an order for 60 engines for Russia.

The length of Russian railroads in September last is given by the "Statesman's Year Book" as 22,530 miles with over 8,000 miles under construction. The mileage in December, 1894, as reported in the table published in another column, was 22,096 miles. The rolling stock in January, 1894, as reported by the "Year Book," was 7,333 locomotives, over 8,000 passenger cars and about 160,000 freight cars.

The Education of Apprentices and Shopmen.

The report on "the apprentice boy" made to the Master Mechanics' Association at the recent convention, and the discussion thereon have awakened a new interest in the important subject of the best means of educating boys for higher usefulness in the railroad shops. Some of our own notions on the subject were given in an editorial published last week. By way of stating more completely what that very enterprising institution, Purdue University, proposes to do in this matter, we publish the following circular issued by President James H. Smart, of the University, under date of May 4, 1896.

The authorities of Purdue University are considering plans for the organization of a series of lecture courses which shall be especially adapted to the needs of mechanics. The plan which seems most likely to succeed involves some features which are new, and members of the faculty who are endeavoring to perfect its details feel the need of help and advice from those who have had experience in dealing with such men. Therefore, if convenient for you to do so, will you kindly look over the outline which follows, and send to the undersigned any comment or suggestion which may occur to you? . . .

It is proposed to organize what may be known as the "Purdue Mechanics' Institute." Through this organization, lecturers who will present scientific and technical subjects to audiences composed chiefly or wholly of mechanics, will be sent to the various industrial centers in the vicinity of the University.

It is proposed to make the lectures valuable from a purely technical point of view, and, at the same time, by abundant illustration, to render them sufficiently popular to interest all who may attend. It is proposed at first to devote special attention to operatives connected with the larger railroad shops, and to extend the work to other establishments as rapidly as the plan can be matured. It is possible that under suitable conditions this plan could be extended into substantial courses in drawing, mechanics, etc., given in night classes, though at present it is proposed to organize for lectures only. . .

It is probable that it would be well to make a small charge; as, for example, 25 cents for a series of five lecttures, though the university is perfectly willing to carry on the work without cost to those receiving benefit, if such an arrangement appears to promise best results.

That the value of the proposed work may be better judged, the following lecture subjects are given from which selections might be made:

1. The Great Bridges of the World, and How They were Constructed.
2. Steam: What it is and What it Does.
3. A History of the Steam Engine.
4. The Developmens of the Locomotive.
5. Locomotive Testing.
6. A Modern Transatlantic Liner.
7. The Building of a Dynamo.
8. Fuels and Their Use in the Industries.
9. Steel Buildings.
10. The Training of an Engineer.
11. The Transmission of Power.
12. The Sunbeam and its Effect on Human Industry.
13. Lessons from the Lives of George and Robert Stephenson.
14. Self-Education, or How a Mechanic may Educate Himself.

It should be added that this work is proposed by the university authorities because it is the purpose of Purdue to encourage the mechanic arts in all possible ways, and it is believed that this can be accomplished in no more effective manner than by reaching directly the operatives themselves. The magnificent equipment of the laboratories of Purdue furnishes special facilities for the illustration of lectures and makes it possible to offer courses of a very high character. . . .

Statistics of the Railroads of the World.

In the two tables which follow will be found, first, the length in miles and by countries of all the railroads of the world and the miles of railroad per hundred square miles of area and per ten thousand inhabitants of each country; and second, the total capitalization and the average capital per mile of the railroads of the principal countries of the earth for certain given dates. These figures are taken from the annual tables published by the *Archiv fur Eisenbahnwesen*. The tables as published in the *Archiv* give the mileage for five years, the increase from 1890 and 1894, absolute and in percentage, and some other information which we do not reproduce. Of course the German tables are made up on the metric units and we have been obliged to convert them at considerable labor. It is possible that in the conversion some errors have crept in, although wherever reasonable checks could be applied this has been done.

The figures for the United States have been changed slightly to agree with those of Poor's Manual and of the Interstate Commerce Commission.

RAILROADS OF THE WORLD AT THE END OF 1894.

Country.	Length of Railroads.	Miles per 100 sq. m. of area.	Miles per 10,000 of Population.
	Miles.		
Prussia	16,688	12.4	5.3
Other German States	11,558	....	.....
Austro-Hungary (including Bosnia)	18,664	7.1	4.2
Great Britain and Ireland	20,903	17.2	5.3
France	24,841	12.1	6.4
Russia (including Finland)	22,096	1.1	2.2
Italy	9,088	8.2	2.9
Belgium	3,445	30.3	5.5
The Netherlands (including Luxemburg)	1,927	14.0	3.8
Switzerland	2,160	13.7	7.3
Spain	7,548	3.9	4.3
Portugal	1,454	4.0	2.9
Denmark	1,409	9.3	6.1
Norway	1,072	0.8	5.3
Sweden	5,738	3.4	11.8
Servia	336	1.8	1.5
Roumania	1,604	3.2	3.0
Greece	569	2.3	2.6
European Turkey, Bulgaria and Roumelia	1,249	1.1	1.5
Malta, Jersey, Man	68		
Total Europe	152,417	4.0	4.1
United States	179,279*	6.0	26.2
British North America and Newfoundland	16,134	0.5	31 9
Mexico	6,990	1.0	6.0
Central America	621	0.3	1.9
Total North America	202,983	.....	.....
United States of Colombia	281	0	0.7
Cuba	1,676	2.4	6.6
Venezuela	634	0.2	2.7
San Domingo	72	0.3	1.4
Brazil	7,496	0.2	5.1
Argentina	8,675	0.8	19.1
Paraguay	157	0.2	3.4
Uruguay	1,119	1 6	14.9
Chile	1,967	0.6	5.8
Peru	1,036	0.2	3.5
Bolivia	621	0.2	2.5
Ecuador	186	0.2	1.2
British Guiana	22	.....	0.8
Jamaica, Barbadoes, Trinidad, Martinique and Porto Rico	457	.....	.....
Total South America	23,799	.....	.....
British India	18,777	1.0	0.6
Ceylon	271	1.1	0.9
Asia Minor	1,100	0.2	0.7
Russia (Transcaspian district)	890	0.5	12.7
Siberia	1,005	.....	2.1
Persia	34	.....	....
Dutch India	1,212	0.5	0.4
Japan	2,237	1 4	0.6
Portuguese India	51	3.5	0.9
Malay States	87	0.3	1.2
China	124	.....	.....
Siam	89	.....	.....
Cochin China, Pondicherry, Malacca and Tonquin	201	....	.....
Total Asia	26,078	.....	.....
Egypt	1,259	0.3	1.9
Algiers and Tunis	2,029	0.6	3 6
Cape Colony	2,443	1.1	14.2
Natal	399	2.4	7.3
South African Republic	615	0.5	7.9
Orange Free State	621	1.3	29.8
Mauritius, Reunion, Senegal, Angola, Mozambique, Kongo	777	.....	.....
Total Africa	8,143	.....	.....
Australia	13,795	0.5	32.4
Recapitulation:			
Europe	152,417	4 0	4.1
North America	202,983	.....	.....
South America	23,799	.....	.....
Asia	26,078	.....	.....
Africa	8,143	.....	.....
Australia	13,795	0.5	32.4
Total	427,215	.....	.....

* Figures taken from Poor's Manual for 1895.

RAILROADS OF THE WORLD.—CAPITALIZATION.

Country.	Date represented.	Miles represented.	Total capital.	Average capital per mile.
Germany	March 31, 1895	27,432	$2.661.045,000	$97,005
Austro-Hungary	Dec. 31, 1891	17.076	1,569.714,000	91,925
Great Britain and Ireland	Dec. 31, 1894	20,903	4,690,444,000	224,391
France	Dec. 31, 1894	22,498	2,939,384,000	130,651
Russia	Dec. 31, 1892	18,441	1,554,448,000	84,295
Italy	Dec. 31, 1890	6 493	734,095,000	110,319
Belgium	Dec. 31, 1893	2,038	263 555,000	129,320
Switzerland	Dec. 31, 1893	2,079	212,498,000	102,211
Spain	Dec. 31, 1889	6.273	540,853,000	86,219
The Netherlands	1887	1,630	132,017,000	80,992
Denmark	March 31, 1892	948	45,425,000	47,917
Norway	June 30, 1894	1,001	36 143,000	36,107
Sweden	Dec. 31, 1894	1,900	76,406,000	40,214
Roumania	Dec. 31, 1893	1,525	115,474,000	76,376
Servia	1894	336	18,864,000	56,143
Total	.....	130,573	15,590,365,000	119,399
United States*	June 30, 1894	178,709	10,796,173,813	62,951
Canada	June 30, 1894	15,765	887,620,000	56,304
Brazil	Dec. 31, 1891	6.388	290.928.000	45,543
Argentina	1893	8,557	407.351.000	48,744
British India	Dec. 31, 1893	18,454	1,077,338,000	58,389
Java	Dec. 31, 1893	607	29,545,000	48,671
Japan	March 31, 1891	978	53,839,000	55 050
Algiers and Tunis	Dec. 31, 1894	1.990	124,099,000	62.361
Cape Colony	Jan. 1, 1894	2,228	95,639,000	42,926
New South Wales	June 30, 1895	2,531	174,270,000	68,855
South Australia	June 30, 1895	1,722	59,597,000	34,609
Victoria	June 30, 1895	3,119	180,510.000	57,874
Queensland	June 30, 1895	2,379	78,646,000	33,059
West Australia	June 30, 1895	550	9 960,000	18,109
Tasmania	Dec. 31, 1894	419	16,749,000	39,971
New Zealand	March 31, 1895	1,993	73,078,000	36,667
Total	.....	246,189	14,355,642,813	58,307

* The figures for the United States have been taken from the Report of the Interstate Commerce Commission. The total mileage includes 2,105 miles, reported as unofficial.

Endless Freight Conveyor of the Texas & Pacific Railway.

The illustration shows an endless freight conveyor for loading and unloading vessels at the docks of the Texas & Pacific Railway Company, Donaldson, La. The view is from the vessel, looking toward the dock.

The conveyor apron is 48 in. wide and is carried by a steel truss, hinged at the inboard end, so that the outboard end may rise and fall with the varying heights of the vessels. The length of the conveyor from center to center is 95 ft. A reversing engine is attached to the side of the truss at the inboard end, which is coupled direct to the pinion shaft that drives the conveyor.

As will be seen from the engraving, there are blocks made fast to the apron at equal intervals, which hold the boxes or barrels as they go up the incline, and when trucks are being sent up they are prevented from running back.

The capacity of the conveyor is limited only by the number of men that can deliver to and take care of the freight, and it makes a saving of about 25 men in discharging a cargo.

This plant was installed in 1894, by the Link-Belt Machinery Company, of Chicago, to whom we are indebted for the accompanying illustration. Similar conveyors have been erected by the same company at the warehouse of the Union Steamboat Company and Western Warehousing Company, of Chicago, and for the Southern Pacific Company at Algiers Dock, New Orleans.

Science and Engineering.*

BY THOMAS CURTIS CLARKE, PRESIDENT AM. SOC. C. E.

The subject of this address is "Science and Engineering," showing the necessary relations between them, which are becoming closer and closer every day, as engineering extends over wider and wider fields of action. Science is the discovery and classification of the laws of Nature. Engineering, in its broadest sense, is the practical application of such discovered laws. . . .

The education of the engineer is now becoming as broad as that of any of the other professions. Engineering has become a profession, but it is the latest of the professions. A brief description of the evolution of engineering will show why it is so. Herbert Spencer has shown that our present professions, law, medicine, architecture and engineering, have all developed from the clerical profession. A little reflection will show that this must be so. A profession requires special education and instruction on the part of its professors. In early times there was but one educated class—the clergy—and they were the only ones who knew enough to be lawyers, doctors, architects and engineers. . . . An art requiring so much technical skill as architecture was originally practiced by the clergy, as temples, churches and monumental structures naturally fell under their supervision. The great cathedrals of the middle ages were built by the higher clergy of those days, among whom William of Wykeham and Abbot Suger are deservedly famous. A curious survival of this is found among architects even now, who call everybody but themselves "laymen."

The earliest engineers of whom we have any record were the priests of Egypt, whose wonderful works in masonry are surpassed by no masonry works of our days; and the only way in which we can show our superiority is by our greater skill in the use of metals.

Civil engineering did not become separated from the clerical profession until in much later times. We know this from the Latin word "pontifex," which means a bridge builder and also a priest, and from which the words "pontiff" and "pontifical" are derived. The Pope of Rome is still styled Pontifex Maximus, Supreme Pontiff, or chief bridge builder, whichever you please.

* Extracts from the Presidential address at the annual convention Am. Soc. C E. at San Francisco, Cal., June 30, 1896.

The building of a bridge was considered such a remarkable feat that the name pontifex became the highest clerical title.

Men of inventive talent, not clergymen, displayed much skill in inventing and operating engines of war, hence the name engineer. Civil engineer was a later title, and thus indicates a later development.

Civil engineering is the youngest of the professions, and the reason of its late evolution is this, if engineering be the application of Nature's laws, there could be no engineering profession until these laws were discovered. These discoveries did not come until late in the world's history. It was not until the human mind had become impressed with the constancy of the order of Nature, and that chance had no place in it, that the reign of law began, and men then strove to discover what were those necessary sequences of cause and effect that we call the laws of Nature. . . .

Men's minds became open to receive knowledge. A common proverb says: "One thing leads to another." Hence it is that science in this century, freed from the stigma of impiety, and using instruments of the most marvelous precision, has been able to make so many new discoveries. Some of those which have been made, even in my day, are as follows:

The evolution of life has been shown by Darwin in his doctrines of variation and the survival of the fittest.

The modern geology, which we owe to Lyell, teaches us that this globe came to its present condition by the operation of natural laws still in force, and not by a series of catastrophes. Its vast antiquity, even since the appearance of man, has also been demonstrated.

The researches of Helmholtz, Joule and Faraday have shown the identity of light, heat, electrical and chemical action as transformations of energy, which has led to what is probably the most comprehensive scientific discovery of this century, the conservation or indestructibility of energy, binding into one law all dynamic action. This shows that power cannot be created, but only transformed, and proves the utter absurdity of Keeley motors and of perpetual motion.

Kirchhoff and Bunsen have given us the spectroscope, which with equal certainty detects the infinitesimal part of a grain of some substance in the flame of a lamp, and also shows the presence of our familiar gases in the light of a star so far away that the ray which now reaches us started on its way before the beginning of Egyptian civilization. The spectrum analysis has created the new astronomy, proving the uniformity of matter, and extending the reign of law all over the visible universe, of which we are but a mere speck.

Such are some of the later discoveries of pure science. Equally wonderful are the discoveries in those branches of science which can be applied to the use of man, and in whose application the engineer takes no mean part.

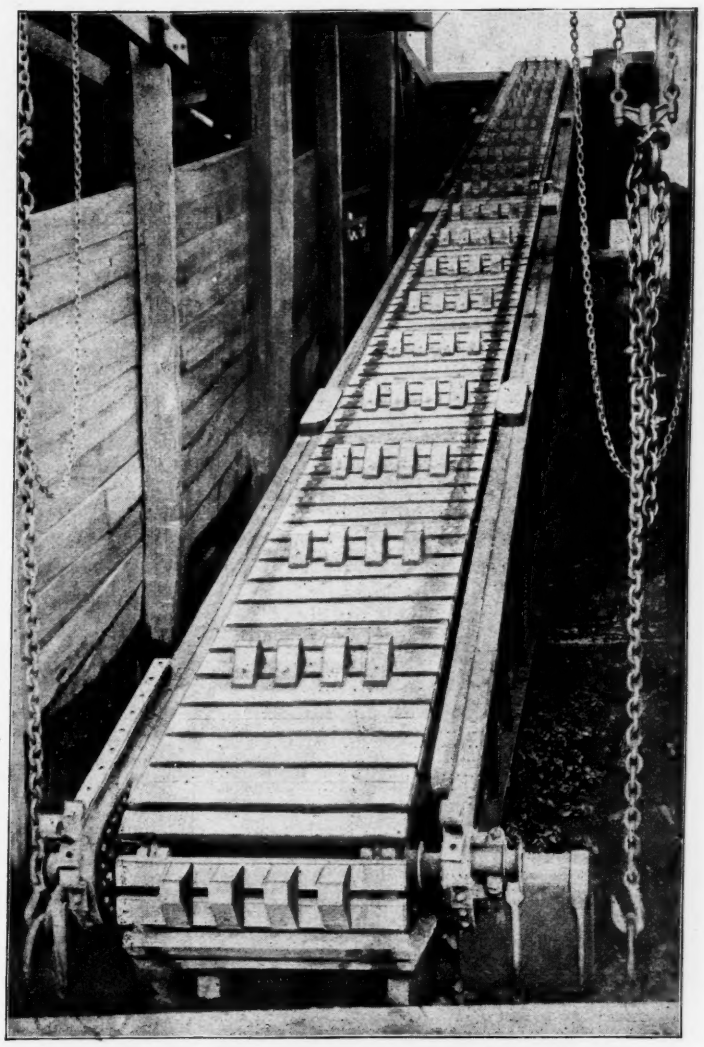
We have now the new chemistry, which is synthetic as well as analytic. In other words, it not only investigates the composition of bodies, but has learned how to create them by its own processes, such as the invention of aniline dyes, oleomargarine and the economic production of aluminum. It has revolutionized nearly every art and manufacture. The engineer Bessemer, in the art of metallurgy, has given us the modern steel which has done as much to lessen the cost of transportation as the invention of the locomotive itself. Another very important late discovery in medico-biological science is that of the presence of those infinitesimal beings called microbes, which, although so small, exercise such a great influence upon human life and health. Here the labors of the engineer have come into play and have shown us how to purify water by sand filtration. The experiments of the engineer of the Massachusetts State Board of Health have shown us that sewage, being destitute of oxygen, must be applied to filter beds slowly and intermittently from above, so that air can follow it down and aerate the purifying microbes, and keep them alive to do their work. By this means the worst water can be made chemically pure.

By far the most striking application of science in this century has been in electricity.

Its new discoveries come so fast that one can hardly write them down. Even while preparing this address a great discovery is announced. It has been the dream of investigators to find some means of producing electrical energy from coal without combustion. We now hear of a very simple process by which over 80 per cent. of the potential energy of carbon can be converted into electrical energy by causing the oxygen of the air to combine with carbonaceous material, through an intervening electrolyte. Assuming that this is true, we may say positively that this discovery will not be of value until the engineer has put it into such practical shape that it will be commercially successful. It may take the place of chemical batteries, but that it can supersede the steam boiler, where great power has to be produced, seems doubtful.

The steam boiler has never had a fair chance until lately. Fuel was crammed under it by ignorant stokers, and the combustion was imperfect for want of oxygen. The scientific engineer has now applied a system of mechanical stoking which develops much more energy from a pound of coal.

Little time is left to speak of military engineers, who are well represented in our society. By them the laws of Nature are applied for the defence of mankind, without which the arts of peace would avail but little. Experience in the last great wars has shown that that nation which has made the greatest advances in engineering is the most formidable in war. It has been well pointed out by the President of the British Institution of Civil Engineers that all improvements in modern instruments of both attack and defence are the work of engineers. High-power guns and armor-plates, repeating rifles and torpedoes were invented by engineers.



An Endless Freight Conveyor for the Texas & Pacific Railway.

Erected by the LINK-BELT MACHINERY CO., *Chicago.*

Engineers are now developing and improving a very old invention, the submarine boat. Modern discoveries have furnished it with aids which appear to at last make it practicable. It can now carry its motive power for use in action in storage batteries. Improvements in handling compressed air make breathing possible. Electric wires can control the discharge of high explosives. If its direction can be controlled, it will revolutionize naval warfare. The battle-ship will have to be designed anew so as to carry several of these submarine boats on her deck. They are torpedoes with men inside of them able to direct them intelligently and evade any nets or other protection that the battle-ship may have. For harbor defense a larger class can be used.

Before the close of this century we may see another new branch of engineering. Through the labors of engineers man has extended his dominion over both sea and land. Through the labors of engineers he may soon extend his dominion over the air, and aviation engineers may be as numerous as mining engineers now are.

Such are some of the later discoveries of science. Each new discovery leads to still another, and what we know now is as nothing to what we will know in coming years.

All the great discoveries of science have been made by the application of what is called the scientific method of investigation. This is as necessary to the engineer as it is to the investigator of pure science.

Unless he is equipped with it and understands its use he will always occupy a subordinate rank, instead of taking his true place as a master of creative science, which I shall show that engineering really is. Scientific method consists of observation, deduction and experiment. It has been well said that a healthful skepticism is the parent of observation. Men are naturally lazy, and it is easier to take things for granted than to observe and find out for one's self. In deduction, we must beware of hasty conclusions. We must be careful not to be deceived into thinking one thing is caused by another because it comes after it.

In forming a theory to account for the phenomenon, one must be very patient and get all the facts first, and not form the theory first and then try and find facts to fit it. This is the pit which scientific men too often dig for themselves and fall into.

The first step, after forming the theory, is to test its truth by renewed observation and by careful experiment, which Huxley calls an artificial observation of facts. The art of experimenting is not to be learned in a day, but should form the apprenticeship of the engineer.

A science becomes complete when its predictions can be verified. Electricity became a complete science when Franklin's prediction that his lighting-rod would protect from the electric flash was found to be true. Engineering became a science when the first stone arch carried its load in safety.

How shall our profession be instructed in the scientific method? In past times every one had to find it out for himself as best he could. Fortunately we have now an abundance of technical schools, in which those intending to be engineers can be trained both mentally and physically in the very things that they ought to know. They can be trained in mathematics and the physical sciences; while in chemical, physical and electrical laboratories they can be taught the essential arts of experimenting. They learn the use of delicate instruments and the art of drawing. Already has been felt in our profession the great influx of young men, trained and cultured in all these things. These schools rank as high, and some think even higher, than the older schools of law and medicine.

Looking at the great numbers of young men who are yearly graduating from the technical schools and entering the ranks of our profession, the fear has sometimes been expressed lest there may not be room for all. Let us look at the great number of divisions into which engineering, following the general law of evolution, has become and is still becoming specialized, and see if there is not yet ample room.

Civil engineering is divided into structural, mechanical, electrical, metallurgical, hydraulic, mining, agricultural, chemical, sanitary, municipal, highway and railway engineering. These classes are again subdivided—as hydraulic engineering into canal, harbor, water supply, power, storage and irrigation engineering. Railway engineering is divided into bridge, foundation, track, signaling, locomotive and car engineering.

Such specializations come constantly to meet new wants. Thus, we now see developing a special class of engineers created by the great value of land in cities, calling for very high buildings, and requiring experts to design their metallic frames and their foundations, made complex by their limited spaces, and the necessity of avoiding encroachment on others.

The general principles of engineering govern all these special applications, and may best be described in the word of Bacon: "Nature can be controlled only by obeying her laws."

Some persons confuse civil engineering with structural engineering. We read in the prospectus of one of our technical schools that courses are given in mechanical, mining, electrical and civil engineering. What is meant is structural engineering, or the art of constructing earthworks, piers, walls, dams, bridges, roofs, viaducts, etc.

The term civil engineering has a much broader meaning, and comprehends all engineering except military and naval. It includes all useful works of sufficient magnitude and intricacy to require scientific method, knowledge and skill in their construction. The civil engineer's true position is similar to that of the architect, who commands the services of many different professions and handicrafts. Mechanical and electrical engineering and many others aid him in their several lines, but from him comes the comprehensive design, and he alone is the director-general of the works. Such is the position claimed for civil engineers in Britain and the Continent of Europe. The members of our society should claim it here, and not only claim it, but show that they are capable of filling it. There is but one way in which they can do this, and that is by showing themselves masters of scientific method and knowledge. In no other way can the vast interests committed to their charge be safely protected. If the engineer has it, and knows how to use it, we shall hear no more of bridges breaking down, dams being washed away, foundations settling, or guessing at the cost of ship canals, those scandals of the profession.

The progress of civil engineers in the future will be far greater than it has been in the past. Civil engineers

will take a much higher rank in public estimation than they have done, and greater emoluments will follow.

Engineering is the great creative science. It has created a new nature governed by Nature's laws, but one which would soon disappear without the support of the engineer. Just as art creates new bodies of men and women, fairer than those of Nature, and literature creates new characters, as alive and real as the people we meet in the street, so does engineering create its new world.

I have attempted to trace the evolution of the engineer from the early days when he knew but little (but what he did know he knew well) down to the end of this nineteenth century whose wonderful achievements in all branches of science have made it absolutely necessary that the engineer should be as thoroughly equipped with scientific method and training as are those who have made these discoveries.

Standing, as I do, near the close of my professional career, I address not only to the members of this society, but to all engineers wherever they may be, this solemn warning—you cannot afford to be ignorant!

When science—the accurate knowledge of what others have done—and experience—the knowledge of what we ourselves have done—are united in the same person, then we may truly say that we have seen the evolution of engineering from a craft to a profession.

Chicago, Rock Island & Pacific Fast Passenger Locomotive, Class 22-A.

The accompanying photograph and drawing show a locomotive recently built by the Chicago, Rock Island & Pacific Railway in their shops at Chicago, which is intended for fast passenger service. As will be seen from the illustrations, it is an eight-wheel engine, with boiler of the extended wagon-top type.

The total weight of the locomotive is 125,000 lbs., of which 83,000 lbs. is on the drivers. The driving-wheels are 78 in. in diameter, being the largest on any locomotive running out of Chicago, except No. 590, on the Chicago, Burlington & Quincy, whose drivers are 84¼ in. The wheel centers are cast steel, and the journals of driving axles 9 in. × 12 in. The cylinders are 19½ in. × 26 in.

The firebox is of the deep, narrow type with a length of 108 in., a width of 32⅛ in., a depth front of 79¾ in., back 68¾ in., and it has a heating surface of 194.3 sq. ft. The tubes are 296 in number and give a heating surface of 1,795 sq. ft., the total heating surface being 1,988.3 sq. ft. The grate area is 24.5 sq. ft. The working steam pressure is 190 lbs. per sq. in.

The tender is of exceptionally large capacity, the tank holding 4,000 gallons of water, and the coal space being for 8 tons.

The design and finish of this engine are very neat, and there seems to be no reason at all why it should not give excellent results in service. We are indebted to Mr. George F. Wilson, Superintendent of Motive Power, for the illustrations and data concerning this engine. A complete description follows:

Builder	Chicago, Rock Island & Pacific Railway
Date of original design	May, 1896
Builder's classification	Class 22 A
Number	1,101
Gage	4 ft. 8½ in.
Simple or compound	Simple
Fuel	Bituminous coal
Weight on drivers	83,000 lbs.
" truck wheels	42,000 lbs.
" total	125,000 lbs.

Main Dimensions.

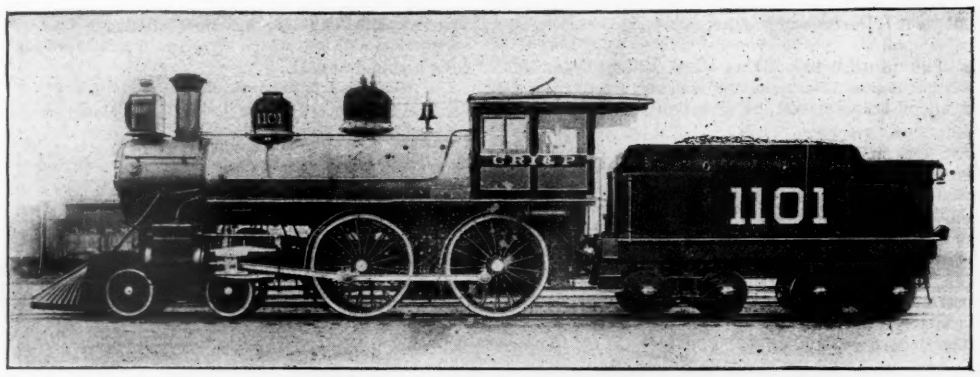
Wheel base, total, of engine	23 ft. 1½ in.
" " driving	8 ft. 6 in.
" " total (engine and tender)	48 ft. 5½ in.
Length over all, engine	30 ft. 2⅝ in.
" " " total, engine and tender	59 ft. 8⅞ in.

Valves.

Valves, kind of	Richardson balanced open top
" greatest travel	6 in.
" outside lap	1⅛ in.
" inside lap or clearance	⅛ in.
" lead in full gear	None
" " constant or variable	Variable

Boiler.

Boiler, type of	Extended wagon top
" working steam pressure	190 lbs.
" material in barrel	Carbon steel
" thickness of material in barrel	⅝ in.
" diameter of barrel at front sheet	61 in.
Seams, kinds of, horizontal, butt joint inside and outside welt strip.	
Seams, kind of, circumferential	Double riveted
Thickness of tube sheets	½ in.
" crown sheet	⅜ in.
Crown sheet stayed with	1⅛-in. radial stays
Dome, diameter	32½ in.



Fast Passenger Locomotive—Chicago, Rock Island & Pacific.

Tubes.

Tubes, number	296
" material	Charcoal iron
" outside diameter	2 in.
" length over sheets	11 ft. 7 in.

Firebox.

Firebox, length	9 ft. 0 in.
" width	2 ft. 8⅜ in.
" depth front	79¾ in.
" " back	68¾ in.
" material	Carbon steel
" thickness of sheets	One sheet ⅜ in.
" brick arch? Yes. No.	Yes
" water space, w'd h.	Front, 4 in.; sides, 3½ in.; back, 3½ in.
Grate, kind of,	C., R. I. & P. standard shaking grate in two sections

Smokebox.

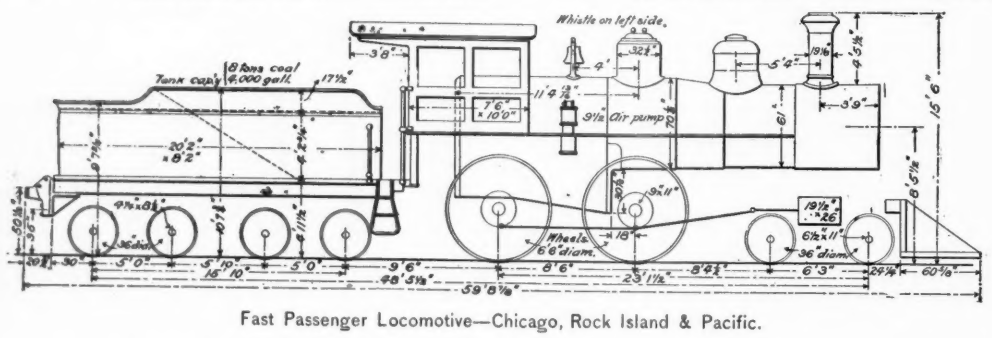
Smokebox, diameter	61⅞ in.
" length from tube sheet to end	67 in.

Other Parts.

Exhaust nozzle, single or double	Single
" " variable or permanent	Permanent
" " diameter	5 in.
" " distance of tip above center of boiler	1 in.
Netting, wire or plate	Plate
" size of perforation	1¼ in. × ¼ in.
Stack, straight or taper	Taper inside
" least diameter	15½ in.
" greatest diameter	18½ in.
" height above smokebox	4 ft. 6 in.

Tender.

Type, six wheel or with swivel trucks	
Tank capacity of water	4,000 gallons
Coal capacity	8 tons
Kind of material in tank	Tank steel
Thickness of tank sheets	⅜ in. and ¼ in.
Type of under-frame, wood or iron	Wood
Type of truck	Diamond, rigid
Truck with swinging motion or rigid bolster	
Type of truck spring	double eliptical in sets of two pairs
Diameter of truck wheels	36 in.
Diameter and length of axle journals	4¼ in. × 8½ in.
Distance between centers of journals	5 ft. 0 in.
Diameter of wheel fit on axle	5 in.
Diameter of center of axle	4½ in.
Type of truck bolster	Oak
Type of truck transom,	Channel iron, secured to frame by end castings



Fast Passenger Locomotive—Chicago, Rock Island & Pacific.

Height, center of boiler above rails	8 ft. 5½ in.
" of stack " "	15 ft. 6 in.
Heating surface, firebox	193.3 sq. ft.
" " tubes	1795.0 sq. ft.
" " total	1988.3 sq. ft.
Grate area	24.5 sq. ft.

Wheels and Journals.

Drivers, number	4
" diameter	78 in.
" material of centers	Cast steel
Truck wheels, diameter	36 in.
Journals, driving axle, size	9 × 12 in.
" truck " "	6½ × 11 in.
Main crank pin, size	5¾ × 6½ in.
Parallel rod pin, size	4¾ in. × 4½ in.
Crosshead pin, size	3½ in. × 4 in.

Cylinders.

Cylinders, diameter	19½ in.
Piston, stroke	26 in.
" rod, diameter	3½ in.
Main rod, length center to center	7 ft. 3¼ in.
Steam ports, length	20 in.
" " width	1½ in.
Exhaust ports, length	20 in.
" " width	3½ in.
Bridge width	1½ in.

Length of tender frame over bumpers	21 ft. 2 in.
Length of tank	20 ft. 2 in.
Width of tank	8 ft. 2 in.
Height of tank, not including collar	4 ft. 3 in.
Height of tank over collar	9 ft. 10½ in.
Type of back drawhead,	Two pocket malleable with separate chafing plate
With or without water scoop	No water scoop

NOTE.—Tank with sides sloping in coal spaces and provided with coal grates.

Makers of Special Equipment.

Wheel centers	American Steel Casting Co.
Tires	Krupp
Axles	Cambria, Coffin process
Sight-feed lubricators	Nathan triple sight-feed
Bell ringer	Baraboo
Safety valve	Ashton, 3 in.
Muffler	Ashton, 3 in.
Steam heat equipment	C., R. I. & P. standard
Reducing valves	Mason
Injector	No. 10 Monitor
Driver brake equipment	American Air Brake Co.
Tender brake equipment	American Air Brake Co.
Tender brake beam	Marden
Tender brake shoe	C., R. I. & P. standard
Driver brake shoe	Sargent Steel Co., Chicago
Air pump	Westinghouse
Air pump governor	Westinghouse
Steam gages	Star, Rochester
Springs	French, Pittsburgh, Pa.
Piston rod packing	Jerome Metallic Packing Co.
Valve	Jerome Metallic Packing Co.
Other specialties	McIntosh air blow-off

Locomotive Rating and Fuel.

At the April meeting of the Western Railway Club Mr. Tracy Lyon, Master Mechanic of the Chicago Great Western Railway, presented a paper with the above title which seems to us to be a particularly good discussion of the subject. We print it nearly in full and add the discussion which was had at the May meeting of the club.

Determination of Engine Capacity.—It has been our experience that the maximum capacity of locomotives over the various grades can only be determined satisfactorily by means of a series of actual tests under favorable conditions, these tests being made with a carefully weighed train with frequent observations of the speed of the engine, steam pressure and cut-off. In making such tests the stops usually necessary in service must be taken into consideration, as their location, as affecting the run which can be made at a hill, governs in many cases the load which can be carried over it.

A theoretical determination of the capacity upon any basis of the computed traction of the engine and the resistance of the train would seem to be entirely unreliable, from the number of physical conditions which of necessity enter into the problem, these conditions consisting of all possible combinations of gradient and curvature variously affected by the location of stations, bridges, crossings and switches, as well as the quality of the track. It may also be said that profiles are not to be depended upon to furnish the actual grades, as the track is constantly being worked upon and changing in a greater or less degree. Such methods are, however, valuable in analyzing the results obtained from actual tests for application to other conditions and in modifying such tests to suit other classes of engines and varying conditions of rail and weather. In making such comparisons it will be found convenient to plot a series of hyperbolic curves, one for each class of engine and based upon their relative traction; one ordinate being the train resistance in pounds per ton and the other the load in tons between the engine and caboose. For such purpose we have found that satisfactory results are obtained by basing the maximum efficient traction, which can be developed at low speeds, upon a mean effective pressure in the cylinders of 80 per cent. of the boiler pressure. The capacity of one class of locomotives over a certain part of the road having been determined by test, that of another is easily and, by our experience, satisfactorily obtained by such a simple comparison of their traction.

As to the train resistances, we find that 6 lbs. per ton fairly represents the wheel resistance of a loaded car under ordinary conditions, to which is to be added the grade resistance and the resistance of curves, which is too indeterminate a quantity to say much about, but is sometimes placed at one-half of a pound for each degree of curvature. After having determined the capacity of the locomotives over the principal grades in each direction, it will be found necessary, assuming that the road under consideration is an average one as far as physical conditions are concerned, to divide it into a series of blocks or sections with reference to the ruling grades, location of stations and other fixed points, each one of these sections representing a different rating. An independent series of sections will of course have to be made for each direction, their terminals only coinciding of necessity at division points.

In determining the limits of these sections there is to be considered: The location of their terminals at points where it is possible and most convenient to drop and pick up cars; the termination of a section when the rating is to be decreased, at a sufficient distance before approaching a hill to obtain such a run at the latter as will permit the maximum load to be carried over it (the importance of increasing the load over a ruling grade and thus increasing the rating of a through train, even at the expense of decreasing the limits of a greater rating, enters here) and the making of the sections as long as possible without too much of a sacrifice in the average rating. With us these sections vary in length from 6 to 75 miles.

Making Up Trains.—Our method of making up trains is as follows: The weight of each car load, both car and contents, is first inserted in the way bill by the agent. Fractions are not used, less than 1,000 lbs. being dropped and over 1,000 counted as one ton. This information is shown on the switch list used by the yard men in making up the train, empties being given an arbitrary weight according to the class of car. The weight of the cars and contents in the train, having been inserted in the conductor's report, is certified to by the agent and this information is sent at once to the dispatcher. At all stations where cars are picked up or dropped, the conductor enters their weight upon his report and also wires it to the dispatcher. It will be found absolutely necessary to check these reports of tonnage—for some time at least—in order to obtain results satisfactory in any degree. One of the principal difficulties to be met with is making proper allowance in the weight of the trains for unfavorable conditions of rail and weather. To the discretion of the dispatcher who receives a telegraphic report of the weather and condition of rail from all stations twice a day, is left the decision as to whether a train shall be made up to first, second or third rating, the yardmas-

ter having standing orders to load all trains to first rating in the absence of other instructions. There are certain exceptions, however, in the case of fast-time freight and stock trains, which uniformly receive second or third rating.

In arriving at such a classification we have made certain assumptions which would seem to be borne out by practice. To the total train resistance in pounds per ton, obtained by dividing the traction of a certain engine by the maximum load or first rating, is added 2.4 lbs. and the loading or rating corresponding to this increased resistance represents the second rating for that engine, that is to say, for an inferior condition of rail and weather. To obtain the third or still inferior rating, representing the most unfavorable conditions ordinarily met with, we add 4.4 lbs. to the train resistance corresponding to the maximum rating. This method would seem to have an advantage over that of making a horizontal reduction in the rating of a certain percentage, in that it decreases it in a proportionately less ratio as the tonnage decreases.

For a train composed entirely of empty cars, a further reduction of 10 per cent. is made in the rating; if only one-half the cars are empty the reduction is 5 per cent., and other proportions in the same ratio. These figures are based upon the assumption that the wheel resistance per ton of an empty car is one-third greater than that of a loaded car, or as 8 lbs. are to 6. The practice of increasing the weight of an empty car to allow for empties in making up the tonnage of a train is sound in principle, but objectionable if it is desired to obtain the actual tonnage.

The Measure of Efficiency.—A system of tonnage rating having been established, there remains to arrive at some means of measuring what is being done.

After all has been said, the sole object in view is to run the trains with as few engines as possible and if they haul as near the maximum loads in one direction as the conditions will permit, the *other* direction will take care of itself. We therefore measure our performance by the amount of the train wages per ton mile *in the direction of the greatest traffic.* This is the keynote of the whole thing.

A daily statement is made giving the tonnage of every freight train, upon which is shown the actual cost of the train wages per 100 ton miles in the direction of greatest traffic, as compared with what these wages would have been per 100 ton-miles if the full rating had been hauled. A separate statement is made for each division in order to compare the work of different men.

Since the establishment of the tonnage rating system on the Chicago Great Western Railway in January, 1894, the increase in the average number of cars per train has been 3 8, or about 21 per cent. This, however, is not a full measure of the benefits derived, as during the corresponding period the average tonnage for a loaded car has also increased by about 15 per cent. As a net result, the weight of the average train, as compared with that before the tonnage rating went into effect, has actually increased by about 40 per cent., in spite of the fact that many more fast trains, and consequently lighter ones, are being run now than previously. This result is further borne out by the corresponding earnings per freight-train mile, which have increased in the same relative ratio.

Coal Tests.—If one is guided by the magnitude of single items of expense, one's attention is naturally directed first to the coal pile. It has been stated in the discussions of this club that it is a mistake that the question of fuel economy should devolve upon the mechanical department. I have never been able to understand this point of view, for certainly it would seem that the mechanical department should be, in the first place, better able to realize the true value of coal than any one else, and can, in the second place, best bring about its careful use by enginemen. The speed of trains and such other matters as are controlled by the superintendents are usually fixed conditions with which we have to contend, but the mechanical department should be able to bring about their modification in the direction of coal economy in so far as this can be done without prejudice to the service.

Considering the possibilities in the varying qualities of coal and that the price usually depends entirely upon the cost of mining and transportation and not in any certain degree upon the true value, it would seem that there has been a singular looseness in the expenditure of the millions which the coal consumed by railroads represents.

The calorimeter test of coal, in which an infinitesimal sample is completely consumed, can hardly be considered as conclusive in any way, or more than a mere indication. A coal of a high calorific value, measured in this way, might be worthless in the firebox of a locomotive. Road tests offer a most difficult means of obtaining *comparative* results on account of the varying conditions to be met with, to say nothing of the expense of conducting them efficiently. The most feasible means of testing coal would therefore seem to be by its consumption in a stationary boiler under forced draft, in connection with a sufficient chemical analysis to determine whether or not the coal is unfitted for use by reason of sulphur or other deleterious constituents.

A year ago such a testing plant was established by the Great Western and some sixteen samples of Illinois, Iowa and other coals were tested before the annual coal contracts were awarded. Each sample consisted of a car load of coal purchased by us of other railroads, with one exception, when it was necessary to obtain the coal directly from the mine. This coal was obtained in box cars as far as possible, in order that it might be received in approximately the condition that it was mined. The plant consists of a small locomotive boiler, carefully lagged, with the steam outlet carried into the stack through a variable nozzle, in connection with the ordinary form of diaphragm. Apparatus is provided to weigh the coal and water (which is fed into the boiler by an injector) as well as the necessary thermometers, calorimeters and draft gages, all the usual observations in boiler tests being made. The grates used are regular locomotive grates and the dampers are similar in construction to those used on the road. The average steam pressure used was 90 lbs., the average draft in the smokebox being being 3.5 in. and the average consumption of coal 90 lbs. per square foot of grate area. Each test lasted eight hours, the coal consumption in that time being 4½ to 5 tons.

After having obtained the evaporative value of each coal reduced to a uniform basis, together with the physical characteristics of each, the prices were taken into consideration and the following computations made: 1st. The relative value of the coals f. o. b. our line, based upon a unit of cost and the evaporative value. 2d. The cost to evaporate 100 lbs. of water at certain points where a number of coals might be delivered to advantage, based upon the actual cost of each coal, the cost of transportation from the various points of delivery to the point where the coal is to be used (depending upon the direction of the greatest traffic) and the evaporative value. The best coal is not necessarily the cheapest.

A great many comparisons can be made with profit based upon various conditions, not only in determining which coal to buy, but in *districting* it afterward. This matter of districting is a very important one, involving as is does the keeping of certain coals within certain districts, as well as the delivery of one coal or another at a certain point, depending upon the supply and direction of traffic.

There can be no question of the importance of using, as far as possible, but one kind of coal on each division, as the adjustment of the engine for a certain coal as far as grates, arches, exhaust nozzle and diaphragm or petticoat pipe are concerned, and the knowledge of how to handle it to greatest advantage by the enginemen enter largely into the economy of its use.

Measurement of Coal Used.—But whether the coal is intelligently selected or not and a certain element of chance enters there, the greatest field for saving lies in the use of the coal on the engine. . . . Recognizing the ton-mile as the proper unit upon which to base coal consumption by locomotives, it has been urged that it would be possible under such conditions to compare the work of different roads. This, however, would not be the case to a much greater extent than upon the old train mileage basis, unless the physical conditions of the roads to be compared were similar. While the unit would be an internal measure of the work done under similar conditions, the ton-mile under dissimilar conditions would represent a widely varying number of foot pounds. It would hardly be fair, for instance, to compare the coal consumed per ton-mile of train on the Lake Shore road with that consumed on the mountain grades of the Union Pacific.

For convenience, we have adopted as a unit the coal consumed per 10,000 miles of total train, including the weight of the engine and tender, and the consumption varies under the same weather conditions from 0.5 ton to 1.2 tons per 10,000 ton miles for different trains, divisions and directions.

The measurement of coal on the engine may first be considered, almost all roads lacking facilities to accomplish this accurately. We have in use for loading coal both buckets and chutes, and in some cases load directly from a car or dock. Where buckets are used, either directly or to fill the chutes, platform scales are provided, and a sufficient number of buckets weighed each day to enable the men to fill them with a fair degree of uniformity—usually to 1,000 or 1,100 lbs. We have experimented with various forms of spring scales hung above the bucket, but, so far, they have proved too inaccurate. The contents of the chutes are gaged by their cubical contents and the weight per cubic foot of the coal used, which is determined by measuring and weighing a considerable quantity of coal in bulk. Where the coal is shoveled directly from the dock, the number of scoops is

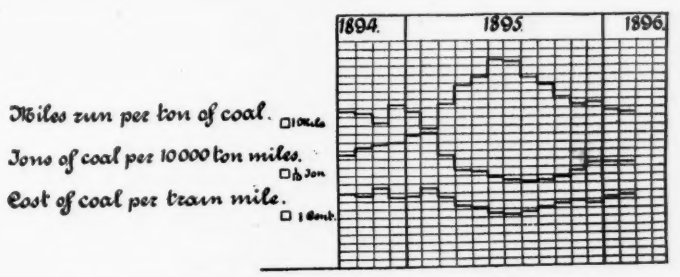


Fig. 2.—With Mr. Lyon's Paper on Locomotive Rating and Fuel.

counted. I find that considerable dependence can be placed upon the judgment of the men who handle the coal, and that they soon get to be able to make very close estimates.

To check these figures to a certain extent we have established a standard location for the back coal boards and gates on all classes of tenders and determined by weighing what the capacity of each class of the latter is as usually loaded. Each tender is marked with a row of rivets on the center line of the side of the coal pit, indicating the number of tons contained when the coal is shoveled into the back of the pit and leveled off with its top, which is done upon the arrival of an engine at a terminal.

Inasmuch as one crew does not run continuously on the same engine, it is necessary to consider each trip by itself in order to obtain each man's record separately.

When an engine leaves the roundhouse the engineer is given a slip showing the amount of coal on the tender; he enters upon this slip the amounts he takes at intermediate points (which are checked against the tickets turned in by the coal men), and delivers it to the Roundhouse Foreman at the end of the trip. The latter measures the amount of coal in the tender on arrival and enters all these items on his daily report of engines "in." There is also shown on this report the time the engine is idle under steam or switching before and after coaling and the amount of coal with which it goes out.

This latter amount is arrived at by adding to the amount on the tender upon arrival the amount taken at the terminal. These amounts are checked as soon as received and entered upon a sheet containing the record of one train for a month. Upon this sheet are shown the total ton-mileage of each train, the consumption of coal, and the number of hours idle under steam and switching on that trip (obtained from the train sheets as well as the Roundhouse Foreman report) and finally, after deducting an allowance of 50 pounds of coal per hour for being idle during steam and 500 lbs. per hour for switching the *net* consumption of coal, which is comparable with the work done. The allowances referred to sometimes do not amount to very much, but they are valuable in their moral effect in assuring the men that their records are true. The amount of coal accounted for in this way usually comes within 1 to 2 per cent. of the amount charged as received.

In order to be able to compare the work of men on different trains and divisions, we have established a basis or allowance in tons of coal per 10,000 ton-miles for each class of train in each direction and on each division, this allowance having been arrived at by a long series of experiments and records of amounts consumed, and representing, not the average, but the best performance which could be expected under favorable conditions. On the performance sheets, which are posted monthly in the roundhouse, are shown, opposite each engineer's name, the amount of coal he used during the month, the amount allowed him (based upon the ton-miles made and the class of service performed), and the percentage of excess of the latter over the former. The performance of the men is, therefore, measured by this percentage: and if they have used less than the allowance, which is not an unusual thing in the summer, the percentage is shown in red—a very enviable distinction.

I do not believe in the premium system; it too often results to the advantage of a few men only and has very little interest for the rank and file. With a consistent method of comparison, the good men take care of themselves: it is the laggards who need attention. Very little can be accomplished by declaring that everything is bad, but if the weak points can be isolated they can soon be wiped out.

In Fig. 2 I have shown the cost of coal per train-mile, the miles made per ton of coal and the coal used per 10,000 ton-miles for all classes of trains, both freight and passenger, for a period of 18 months. It will be seen that while the coal per ton-mile represents a fairly uniform curve the train-miles per ton vary at times without apparent reason.

We consider it best not to make any changes in the allowances for even the extremes of weather, preferring that there should be established for the relation between the actual consumption and the base, what might be called a curve of temperature. The increase in consumption of coal per ton-mile during the winter months would seem to be about 25 per cent. of that consumed during the summer. It will be noticed that there is a marked decrease in the amount of coal consumed per 10,000 ton-miles as compared with that consumed during similar periods of the previous year, this decrease amounting to about 24 per cent., which we think fairly attributable to systematic and consistent methods of keeping account of the coal.

It must also be considered in this connection that the weight, as well as the speed of trains, has been gradually increasing during the period covered, which accounts for the fact that the cost of coal per train-mile has decreased to such a slight extent. This is especially noticeable in the passenger trains, the average consumption of coal per ton-mile of passenger trains over that of freight trains having increased from 28 to 45 per cent. in consequence of changes in schedules made within the last few months.

The additional expense incident to this work is represented with us by the cost of the stationery needed and by the wages of two clerks, whose entire time is devoted to tabulating the reports and getting out the performance sheets, and possibly a helper at roundhouses where the force is already at the minimum point, in order that the coal may be properly shoveled into the pit of the tender.

Our men are now thoroughly interested in the matter of coal consumption—which is half the battle—and I think feel on the whole an entire confidence in the records. Their work as far as coal is concerned is now considered as one of the most important factors in their personal record, and it is understood that a continual poor coal record will result in dismissal, or at least a loss of rank

With the tonnage system the men do not shirk heavy trains, they would prefer to pull the full capacity of the engine, as by so doing they can make their best record. The only tendency which we have to combat is one of crawling up hills, and running down them at too great a speed.

DISCUSSION.

Mr. J. N. BARR (C., M. & St. P. Ry.): I take a great deal of interest in all that Mr. Lyon has to say in his paper, and my opinions on the subject agree fully with his. I think that giving the matter of coal consumption the attention which it is given on that road, or, in fact, the attention in a less systematic form which is given on a great many roads, has resulted in an enormous economy. I notice his concluding remark: "The only tendency which we have to combat is one of crawling up hills and running down them at too great a speed." I do not know whether that tendency should be combatted very seriously if we are looking for the best results for the railroad. If we are looking to make a "fly run," then I think that tendency should be very seriously combatted. I think that the adage which was in effect some years ago, and which I thought had died out at the present time, that the proper way of running a train is to go as fast up hill as down, is one of the most pernicious that has ever been brought forth. I think the persons that started the adage did not know anything practically about the operation of the train, and I do not think that, so far as economy, good results, making a good train sheet, and every other point necessary to satisfactory railroading is concerned, you could go on a worse principle than that of going up hill as fast as you go down.

There is another point in going down hill that seems to be an objection to going fast. I do not know whether it originated from the fact that a horse going down hill is liable to stumble; it possibly did. But hills that we talk about on a railroad are not the hills that we encounter when we are driving a team. Almost the maximum grade is about 50 ft. to the mile: the average is probably considerably less than that, still they are called hills. Now the objection, I presume, to running fast down hill is—I will make a guess at it—that if the engine gets off the track you will do more damage than if you were running on a level; but I would like some one to figure out or to give me an idea how much further a train would run if it got off the track going down a good grade than it would if it got off at the same speed on a level. I question whether you would find much difference. I question whether if it did get off you would find an additional broken coupler if you were on a 30-ft. grade, as compared with being on a level. So I think in this whole matter that the old adage that proper railroading is to run a train up hill as fast as down has done considerable mischief.

I saw a letter from a general manager the other day asking about our system of keeping accounts of fuel. The final inquiry was, "Don't you find that engineers are not willing to make good time on account of their endeavors to make a good fuel record?" This is something that we have heard a great deal about. Now with Mr. Lyon's arrangement, as is the case on a great many other roads, we take the tonnage instead of the train. A 10-car train, when a 30-car train is the train for a certain division, can be hauled for much less coal, but in taking the tonnage a 10-car train cannot be hauled for as small an amount of coal per hundred tons one mile as a 30-car train can, and the engineers and the enginemen are quick in finding that out. Where the principle is adopted of measuring the tons instead of simply calling them trains, you will find the engineers complain when they do not have a full train, instead of considering it a decided advantage to their record.

Mr. G. W. RHODES (C., B. & Q. Ry.): I do not know whether the author of the paper means that the mechanical department alone should look after the coal. I do

(*Continued on page 493.*)

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

We do not assume for a moment that all the engineers responsible for electric railroads are mere electricians. In the last two or three years considerable good civil and mechanical engineering has gone into the building and working of those enterprises, but a good deal of the earlier work was done by electricians who had no right to call themselves engineers, aided by horse railroad superintendents and working under directors who knew no more of the forces of nature and the strength of materials than a floor walker in a drygoods store. But the forces of nature have not ceased to work, as some investors are learning. Several striking instances have been recorded in these pages in the last few months, and Mr. Stowell calls attention to some of them in an article in this issue in which he discusses the matter of bridges for electric railroads. We ask the especial attention of those who are in any way responsible for such bridges to that article.

The receivers of the Norfolk & Western have printed a pamphlet containing their correspondence with the Commissioner of the Joint Traffic Association concerning the reasons why that road has not joined the Association, and also their report on the same subject to the Reorganization Committee of their road. The pamphlet sets forth that the Association Committee did not try very hard to get the receivers to join; that the Norfolk & Western is a new competitor in the trunk-line field and that therefore it could not afford to join an association where it would have to depend upon the judgment of three arbitrators to get its rights; and that it has only taken enough eastbound export grain to get cars to carry its westbound business. Formerly it got these cars from the East Tennessee, Virginia & Georgia, but the sale of that road to the Southern Railway has deprived the N. & W. of this eastbound business. The agreement of the association is also criticised as affording insufficient protection to weak lines. To one unacquainted with the facts, the pamphlet (which consists largely of extracts from correspondence concerning alleged secret reductions in rates) can hardly be said to afford full ground for an opinion in the premises; but the impression after reading it is that rates on export freight were raised or lowered as often as seemed desirable without a thought of the law requiring such changes to be published. We have always understood that the Interstate Commerce Commission, acting under Sec. 6 of the law, required such changes to be published in precisely the same way that inland rates are published. The Norfolk & Western people reassert their intention to co-operate with the association in maintaining rates, but whether or not they have always consulted the Commissioner, before making reductions, sufficiently to make their practice consistent with this assertion, does not clearly appear. Mr. Bullitt, the Traffic Manager of the Norfolk & Western, says that the Chesapeake & Ohio used fictitious ocean rates in order to maintain the inland tariff. He holds that it is utterly impracticable to keep inland rates steady on export freight as long as ocean rates must constantly fluctuate, and therefore he will continue to adjust his export rates according to those which he believes his competitors to be making *from point of shipment through to the European destination.* (As ocean rates are generally higher from Norfolk than from the larger ports, this means that the N.& W. expects to make its inland rates lower than those of the other roads.) He believes that he has always got as high rates as his competitors; that is, he has met their rates, but has not cut under them. It is quite evident that the receivers will not join the association until there shall have been a great deal more discussion between them and those association roads which are their principal competitors. They look upon it as "singular" that they should be asked to "protect the revenues" of these association roads while the latter are actively fighting the Norfolk & Western on coke rates to the West (coke not being included in the agreement). This last is a familiar complaint in negotiations of this kind. When it is impossible to include all the traffic in an agreement it is generally a good thing to include as much of it as possible, but this is a point hard to argue, and there is no help for it but slow and patient discussion. It took a prodigious amount of such discussion to convince the original 32 roads of the desirability of joining the association, and now, apparently, it will take as much to convince this one as it did to convince the whole 32.

In *Public Opinion* for July 2 Mr. H.T. Newcomb, Statistician of the Department of Agriculture at Washington, discussing the "Problem of Railway Labor," recommends that Congress, whenever it shall authorize pooling of traffic or earnings, add to the bill a proviso to protect the rights of laborers, and he would do this by guaranteeing them reasonable compensation and treatment and a reasonable maximum number of working hours daily. The Interstate Commerce Commission or some other body should, he believes, investigate complaints and in labor controversies protect men from discharge. Mr. Newcomb would protect the railroads by annulling the charter of any labor organization which should order a strike "during the process of an investigation." It seems to us that the scheme would find one of its greatest difficulties before it began, if that is not too Irish. How much would the labor unions care for a charter from Congress? Without stopping to discuss the constitutional obstacles to a Federal law on a matter which is essentially a police regulation, or the difficulty of fitting it to the facts and enforcing it, even if it were constitutional, it is fair to inquire whether the brotherhoods would deem the probable benefit of sufficient value to warrant them in giving up the right to strike whenever they please. Congress has discussed eight-hour laws and the like times without number, but they have failed because discussion very soon revealed their impracticability and because, broadly speaking, the workingmen had no real grievance which the proposed laws could remedy. The absurd results of the working of the eight-hour law passed by Congress in a field where it has full power, that for the benefit of letter carriers in cities, illustrate the kind of "protection" which Congress would be likely to afford railroad employees; protection at the expense of efficiency. The article suggests that railroads strenuous for a pooling law ask their employees to assist them in getting the law passed, with the proposed amendment. One difficulty with this proposition is that some of the railroads are not so very strenuous. When the last attempt was made some prominent roads were quite lukewarm in their advocacy of pooling. The competetive rate-problem is a very difficult one, even *with* pooling: and since the directors of the principal roads have adopted rational methods of dealing with this problem without a pool, we suspect that some of them are still less solicitous about the pooling bill. As long as "The Problem of Railway Labor," like that of all other labor, is admitted on all hands to be a very difficult one, it would seem the part of wisdom to follow pretty closely the lessons of experience; and every railroad brotherhood has such a lesson, worthy of careful study, in the organization of the locomotive engineers, directed by Mr. Arthur. Mr. Newcomb, like all the soberer men who tackle this subject, aims to secure prompt and frank discussion between employer and employee when trouble impends; but while government arbitration boards and bureaus nearly always prove to be clumsy instrumentalities in this field, Mr. Arthur has achieved success all by himself.

Yard Limits.

A correspondent asks why we do not agitate the subject of yard limits. Many roads have limit posts, but seem to care very little about the enforcement of the rules regulating their use; others provide none where they are greatly needed, thereby making much extra work and anxiety for switching crews. These latter are the smaller roads, and yet some of the big roads are equally oblivious to any demand for better system. Some take pains to establish limits at a good many stations, but exhibit poor judgment in locating the posts, and do not get from them the benefit they ought to.

Various defenses might be offered for whatever negligence we may have been guilty of; but perhaps the most influential reason why we have not agitated the subject is that the men who ought to attend to this matter, the General Superintendents, are not at all stirred up about it. They seem to be contented to let things stand as they are. We are forced to conclude that the Division Superintendents get along so well with imperfect arrangements that their superiors feel no necessity of improving their appliances or regulations. We suspect that our correspondent himself ought to agitate his superior officer a bit.

A road which has interlocked signals and run trains by space intervals has little need of special rules for yard work, for the whole of its line, outside of yards, as well as in, is within such control that the occupancy of the track and the time of the yard men are economically adjusted without special effort. Some companies have these improvements on a small part of their lines, while a large part remains under the old regime; on these roads it often looks as though the satisfaction of the officers with what they have accomplished blinds their eyes to the things yet remaining to be accomplished. But whatever the yard-limit rules on any road or the extent of their application, the improvement in the enforcement of the flagging rule during the last few years seems to have raised the efficiency of trainmen to a plane where yard-limit regulations, good and bad alike, are a secondary matter. If they are well-adapted to their purpose, they are taken advantage of; if not it is simply a question of so much more flagging, and the flagging is done. For years the lesson has been drilled into trainmen that "nothing will justify a collision"; if the rules do not provide sufficiently against the danger, make a rule for yourself. This precept constitutes a blanket rule, making up for deficiencies in other rules; and, favored by a decreasing business and fewer changes in the men, it seems to have served its purpose of late years better than ever before.

But a yard-limit rule, even if secondary, is not unimportant, for it may be made to greatly facilitate switching and save time. A block-signal section including the yard is the ideal "yard limit," and, as already intimated, the use of the block system at any station takes that yard out of this discussion. At the other extreme is the "yard," that is, the switches at a station, where so little work is done that it would require a regular force of detectives to make trainmen obey the requirement to always approach under control. Between these extremes there are yards of all degrees and the problem is to make a rule for the whole which will be sufficiently uniform to be easily remembered. Better no rule at all than one which a man at fault can evade by pleading confusion as to its meaning.

A yard limit is to permit trains to do switching (or to stand) in the yard without sending out a flag. The yard which is too poor to afford any kind of a fixed signal must have one rule for freight or slow trains and another for passenger trains; or, rather, it must not attempt to interfere with passenger trains at all. The only simple rule is for *everything* except first-class trains to *enter* the limits of the yard under *complete* control. That means, be able to stop at any point inside the limit post, if a car is found standing on the track. If the road is straight, the weather clear and the track unobstructed, this may mean a speed of forty miles an hour; with a crooked road, or in time of fog it may mean as low as three miles an hour. There is no safety unless this rule is enforced uniformly at all yards to which it is applied, and every day alike. If the rule is enforced in the day time, but not at night, the dividing hours ought to be the same at all such yards. The attempt to enforce 6 to 6 at one place, 7 a. m. to 8 p. m. at another, and so on, is pretty sure to be unsatisfactory; there will be some enginemen who will fail to fix the hours in their minds, and the value of the rule is greatly impaired.

Allowing yard men to use the main track in the face of freight trains without flagging, but not in the face of passenger trains, implies that the number of passenger trains is not so large, but that the exact time of each can be easily kept in mind; and also, we may add, that the schedules are not to be changed very often. Where passenger trains are numerous, or where some of the freight trains are required to make such fast time that they cannot afford to slacken at every yard, the limit post must be supplemented by a distant signal. The distant signal should

not be used without the limit post, for then the enginemen will dispute as to what the signal means; as to *how much* they must reduce speed when passing it. A distant signal must convey the same meaning to all trains, in order not to be inconsistent with other distant signals (at crossings, for instance) and therefore it must be far enough off to give passenger trains space enough to stop in before reaching the limit post. Even if the signal is never used to stop a passenger train, this is necessary, for to require enginemen to read one signal one way and another precisely like it, in another way, has a bad effect on the whole signal discipline. Whatever the distance decided upon for the distant signal, whether 1,000, 1,500 or 2,000 feet, the rule should require *every train* to so run as to be able to stop within that distance if the signal is against it, unless the way is seen to be clear.

A distant signal that is to be left for long periods of time in the all-clear position should be perfect in every respect, so as to surely go to the caution position when the lever is moved to that position. The only perfectly satisfactory rule for using such a signal is to require the conductor to know personally that the signal is in the caution position before fouling the main track or depending upon it for protection. As a road which cannot afford to put in an automatic signal may be assumed to be too poor to put in an electric repeater for each distant signal, and in view of the possible inefficiency of *any* signal at small stations where a qualified inspector cannot make frequent visits, it is perhaps well to require the conductor, if the signal is out of his sight—as in case of fog—to send a man out far enough to *see* that the signal actually indicates caution.

The "yard" should never be extended farther than is necessary for everyday work, and never very far even for that. If incoming trains frequently have to wait before they can go upon a siding or get a chance to take water, the limit post may be set back far enough to cover *one* of the longest trains standing outside the switches; but if trains are very long even that often proves far enough to cause considerable unnecessary delay to the great bulk of the train movements. To try to cover two standing trains or to take in switches remote from the station proper is almost sure to weaken the necessary safeguards or else make the yard-limit rule an obstruction instead of a benefit. Trains will take the chances of running *not* under control and yard crews, knowing that the rule is not observed, will fall into the habit of acting on their own judgment or trusting to luck; and they do not need to maintain that attitude of mind a great while before they become shaky on all branches of discipline. The vital point in yard-limit discipline is to have the conductor using or occupying the yard feel perfect confidence in being there without sending out a man with red hand-signals and torpedoes, and to have all trains which may approach, while he is working in that confidence, obey the rule with such precision and care as to perfectly justify the confidence.

Demurrage on Freight Cars in England and America.

It is interesting to note that our English cousins, as well as ourselves, have some little difficulty now and then in collecting demurrage. Since the Board of Trade, at the command of Parliament, has reduced freight rates all over the kingdom the railroads have, of course, taken every opportunity possible to recoup themselves by cutting off losses in various directions and by increasing rates slightly in some cases where the law allows; and among other things it appears that, in one case, the demurrage charge on coal cars, which had been averaged, was changed and the bills figured "straight" on the old plan. Making allowances for cars unloaded with more than usual promptitude defeated the object of demurrage, for it so reduced the bills for cars detained that consignees relaxed their efforts to unload promptly. The change now made has, of course, increased the cost to the owners of the coal, and one of them complained to the Government Commission. The action of that tribunal is reported in *Herapath's Journal* as follows:

The Railway and Canal Commission (Mr. Justice Collins, Sir F. Peel and Viscount Cobham) on Friday last heard the case of the Manchester and Northern Counties Federation of Coal Traders' Association v. Midland Railway Company, which was an application for the order of the court declaring whether or not the charge of 6d. per wagon per day for detention by the freighters after four days, exclusive of the day of arrival, is a reasonable charge. The coal merchants were formerly charged a siding rent for detention of wagons on a system of averaging the number of days. Defendants levied a siding rent-charge of 1s. per wagon per day, excluding the day of arrival. They adopted as their unit of measure the total user of a given siding during each separate calendar month. The period so measured was allowed by defendants to amount in each month to a certain number of days, and on the conclusion of the average period allowed, the charge of 1s. was levied. The company stated, in their answer to the application, that detentions arose under the average system, and they, therefore, reduced the charge to 6d. per wagon per day for each day beyond four days, exclusive of the day of arrival. Experience, the company set forth, had proved that four days was the reasonably necessary period of detention. The freighters objected to the alteration in method of imposing the charge, on the ground that it indirectly increased the [transportation] charges. The railroad said that the effect of the new system had been to liberate thousands of wagons for the carrying on of the coal trade.

The President (Mr. Justice Collins) gave judgment, and said the application raised rather a subtle point, but he had come to a perfectly clear conclusion upon it. The learned counsel had argued that, whereas, under the old system, coal merchants got certain accommodation in return for their tonnage rate, the period during which they might detain wagons had been cut down under the new system, and, therefore, the trader, by reason of the reduced accommodation, was subjected to an increased burden.

Upon a careful examination of the evidence the court was clearly of the opinion that there was no difference whatever in the accommodation afforded to the trader. The new arrangement was precisely the same as the old system—namely, that four days were allowed, exclusive of the day of arrival, within which the operation of unloading was to be performed. The charge had been reduced to 6d., and the only change was that, with a view to ensuring despatch in emptying the wagons, the company no longer carried to the credit of traders days which they had saved by the rapidity of unloading. That was all the change. The court had no hesitation in coming to the conclusion that the application had not been made out. The judgment of the court was accordinly in favor of the Midland Railway.

Justice Collins' name will pass for good English (or Irish), but his justice looks to us like the Dutch variety. The railroad does not let you off so easy as under the former rule, but nevertheless I decide against you! Dutch justice is, however, in this case genuine justice, for the use of a car beyond four days after its arrival at destination is no proper element of transportation, and the cost of it should never be included as a part of the transportation charge, either for purposes of comparison or for any other purpose.

At Cleveland, O., large receivers of freight have for several years been allowed to pay demurrage on the 24-hour average basis—paying nothing at all if their cars averaged only 24 hours each, even though some cars stood in the yard three weeks—but we have never heard any pronounced argument in favor of this plan except that it enabled the railroad to get a contract under which the consignee paid his demurrage without demurring, which is not an insignificant gain. From 25 to 35 per cent. of the cars handled by the Cleveland Car Service Association are charged for on the 24-hour average basis. With some consignees this plan would be detrimental to the carrier as it would remove the incentive, which every receiver of bulk freight ought to have, to order his goods shipped at reasonable intervals, and not in large quantities at once; but aside from this the plan ought to be generally equitable, we should think, if the allowance of free time is rightly adjusted. Twenty-four hours after the cars are placed must in many cases be very favorable to the consignee. Whenever the railroads adopt the per diem plan for interchange, the average idea will not be so easy to manage, for consignees will often want to unload your own cars promptly and have that promptness offset delays in foreign cars on which you are paying out money every day.

Not the least interesting part of this English case is the rate charged for demurrage. English coal cars probably average less than 10 tons capacity each, but even at that 24 cents a day looks to an American like a pretty small charge. We are not sure, though, but it would be profitable at many American stations to reduce the present charge of a dollar a day. A lower rate would justify a shortening of the free time, where it is very long—as it is in many cases—and thus probably tend to release the cars sooner; and it would do away with an immense amount of friction in the collector's office.

Annual Reports.

Atchison, Topeka & Santa Fe.—The receivers of the Atchison, Topeka & Santa Fe have issued a brief report this week, giving a summary of the results of the operations of that property during the receivership. The road was turned over to the receivers on Dec. 23, 1893, and the new company took charge of the property on Jan. 1 of this year, so that the receivership lasted just two years and eight days. The road directly controlled by the receivers was the 4,582 miles of the Atchison proper. Indirectly they controlled the Gulf, Colorado & Santa Fe, the Southern California and other lines, 6,482 miles of road altogether. That is the mileage owned by the present company. The receivers for a time were also in control of the St. Louis & San Francisco, the Atlantic & Pacific and the Colorado Midland, being appointed receivers of those lines under separate proceedings.

The financial results of the Atchison and subsidiary lines (4,582 miles) were as follows for the two years of the receivership:

Gross earnings		$42,248,912
Operating expenses		32,976,089
Net earnings from operation		9,272,823
Received from A., T. & S. F. R. R. Co.		
Assets.		
Cash and accounts receivable	$2,988,264	
Fuel, material, supplies, &c.	1,028,608	
Other prior assets (net)	377,009	
		4,393,882
Received from system lines G., C. & S. F., So. Cal., N. M. & A., Sonora (net remittances)		876,225
Income from investments (coal and land companies, etc.)		594,075
Temporary loans from Joint Executive Reorganization Committee		$1,665,952
Total to be accounted for		$16,802,955
EXPENDITURES.		
Taxes, rentals and interest		$3,054,114
Construction, improvement and equipment		1,505,534
Profit and loss, depreciation in material, and accounts charged off		47,462
Payments for A., T. & S. F. R. Co. obligations		7,019,397
Payment account principal and interest syndicate loan		655,770
Payments for bonds and coupons		4,584,405
Total expenditures		$16,866,682
Balance of current liabilities in excess of current assets taken over by A., T. and S. F. Railway Company		63,725
Total accounted for		$16,802,955

The report gives a statement showing the results of operation from all the lines under the receivership, including the companies in which the Atchison has a half interest. The gross earnings from all these companies were $58,537,391; operating expenses were $46,123,764; net earnings, $12,613,627; other items, $664,993; taxes and rentals, $4,076,165, leaving a balance of $9,202,455.

The receivers spent $2,806,443 for construction, improvements and equipment. The value of the material and supplies on hand at the conclusion of the receivership was $1,307,003. The balance of current liabilities in excess of current assets taken over by the new company was $1,572,062. The new company secured funds under the reorganization plan to more than meet all assumed liabilities, and began its operations with no floating debt for accounts not provided for.

The receivers point out that the period during which they had control was one of exceptional distress and difficulty. The business depression which began in the the summer of 1893 largely diminished earnings, and was the immediate cause of the receivership in December of that year. Of course there were other embarrassments. The earnings of the line have never returned to what is termed a normal volume. The Kansas corn crop was almost a total failure in the first year of the receivership and in the second year the wheat and cotton crops were light, and the movement of corn was small. In 1894 there was a long strike in the coal fields, as well as the American Railway Union strike, and in the next year serious storms and floods in the mountains interfered with train service and required heavy renewal expenses.

The operating expenses were 78 per cent. of the gross earnings. The statement points out that this high ratio of operating expenses is accounted for by the amounts spent for maintenance of equipment and for maintenance of way and structures, which were particularly heavy in 1895. The receivers state that many economies were brought about in the cost of transportation and traffic expenses and in general expenses, and they believe that these economies can be continued still further, particularly in increasing the train-load in the train-mileage tonnage.

The improvement expenses, it is pointed out, amount to $1,429,000 and the new company ought not to have to make any unusual renewals for some time. In addition to the sum given above as charged to improvement account large amounts were included in operating expenses, the policy of the receivers being, where improvements were made, to charge the estimated cost of renewal to operating expenses and the amount above that to improvements. Thus, where a steel bridge was built to replace a wooden structure the extra cost of the new bridge over the cost of putting in a new wooden structure was charged to improvement account and the rest to operating expenses. Air-brakes have been used on freight trains for several years and the work of putting on automatic couplers was commenced. The receivers suggest that new coal and stock cars may be needed.

The principal extraordinary expenses not charged to improvement account were in maintenance of way and structures. Renewals of ties increased from $775,000 in 1893 to $1,443,000 in 1895. Renewals of bridges and culverts increased from $779,000 to $1,144,000, and renewals of rails and fastenings from $408,000 to $547,000. The mileage of wooden bridges was materially reduced and many trestles filled with earth, and many arch and pipe culverts were built.

A report of Mr. Aldace F. Walker, as Chairman of the new Atchison company, is also published. This shows that the Reorganization Committee held for the new company in January last, about $2,7000,000 cash and over $13,000,000 par value of securities. Later, $5,565,000 of St. Louis & San Francisco bonds were sold at 35, realizing in cash, $1,971,550, increasing the cash held by the committee to $4,671,550. In January, $1,200,000 was paid by the committee to the new company chiefly for interest payments. The balance of available cash is thus $3,471,550. Since Jan. 1, the new company has made interest payments of $2,324,018, all from earnings of the road, except $1,000,000 as stated above, received from the Reorganization Committee. The total annual fixed charges on Jan. 1 last were $4,662,030. During the year, $863,000 of the new general mortgage four per cent. bonds, have been issued to the amount of $863,000, to refund bonds with a higher interest rate. The fixed charges have thus been reduced to $4,650,590 or $387,549 a month.

The following statement shows the earnings of the new company for five months in 1896 with comparisons with 1895:

	1896.	1895.	Inc. or dec.	
Gross earn	$11,441,460	$11,364,664	I.	$76,796
Oper. exp	8,486,838	9,236,814	D.	749,976
Net earn	$2,954,622	$2,127,850	I.	$826,772

The operating expenses are now 74 per cent. of gross earnings. The earnings, including income from investments, were $11,488,058 for the five months. Expenses, including rentals and taxes, were $9,174,464, leaving a profit of $2,313,594. Charging against this the fixed charges for five months, $1,937,746, there is left a balance of $375,848.

The heterogeneous character of American civilization is often brought to the attention of the railroad manager. He is constantly coming in contact with people whose demands in respect to treatment and facilities show that they have been brought up in the most refined surroundings, while, intermingled with these, are others, equally estimable from a practical point of view, whose standards of social propriety are few and simple. One class wants the telegraph poles whitewashed and the ends of the ties sandpapered before taking a ride over the road in a parlor car, while the other is satisfied with a seat in the caboose if the price is right. Some people want the coal-cars fitted with rubber tired wheels, while others not only make no objection to noise, but are glad to have a liberal amount of it, so as to infuse a little life into their sleepy hamlets. But one of the most amusing cases that we have heard of is that of some people in Toledo, whose tastes are at once both urban and rural: they want the quiet, the elegance and exclusiveness of an Eastern university city while at the same time enjoying the freedom of the breezy West, where the locomotive, the gentleman's carriage and the unpenned pig occupy common ground in democratic friendliness. These people, says a Toledo paper, object to the noise of the whistle. "The residents along the Wabash terminal between Congress street and Broadway crossing have come to the conclusion that the 'toot' of a locomotive whistle is a nuisance. There is an ordinance against it and they have asked the Council to enforce it. This places the railroads in a very embarrassing position. Many of the good people of that part of the city have cows which roam at will over the commons. For some reason 'bossy' thinks the sweetest grass grows along the Wabash tracks. Time after time the Wabash engineers are compelled to use their whistles long and loud on the good milch cows to drive them off the track. This makes the people along the railroad very wrathy, and hence the vigorous kick on their part." When the whistles shall have been silenced, the next demand, we presume, will be for faster time. To the ordinary mind the problem of running a mile a minute, while still looking out for brindle cows along the track, is a very difficult one; but the Western railroad manager must grapple with it or he isn't fit for his job.

A Chicago press despatch says that the officers of the Chicago & Alton have discovered a scheme by which the road was being robbed systematically by two of its passenger conductors and a station agent. One of the conductors took up, but did not punch tickets sold at Springfield for Chicago. Meeting the other conductor at a way station, he sent the tickets back to the station agent, who resold them. The most interesting thing in this report is the evidence it gives that cheating can be done in quick time in case of need. The Chicago & Alton limits its local tickets to two days and this short limit, since adopted by many other roads, is a valuable safeguard against the fraudulent use of tickets a second time. But 48 hours, or even 24, is a long time for carrying out a transaction that can be accomplished in six hours, and if any one has heretofore doubted the possibility of manipulatinn short-time tickets he can here find ample warrant for revising his opinion. The incident recalls the fact that the very best safeguards against dishonesty that are now employed on American trains are far from perfect. Conductors have in former years stolen enormous sums, so large indeed that managers in many cases seem to have lost heart; and on making a reform which restores a large portion of the road's passenger revenue to the right channel they are so overjoyed that they apparently forget the small comparative, but large absolute, amount still going to waste. When a manager gets to the point where he can select for conductors as large a proportion of honest men as we find, say, among bank tellers it may perhaps be found economical to follow the slipshod plans of accounting now in vogue, but if the personnel is to remain at its present level the simplest lesson of experience would seem to indicate the need of much more thorough inspection than any one has yet employed. In services where the highest possible perfection is aimed at, as on the Pullman sleeping-car lines, the money spent for inspection is a much larger percentage of the total payrolls for conductors' service than railroads generally feel warranted in allowing for that department; but the expenditure seems to be regarded by the company as a profitable use of money, else it would not be continued. Railroad officers will have to make up their minds to a similar expenditure if they want the same satisfactory result.

NEW PUBLICATIONS.

Official Railway List. Chicago: The Railway List Company, 1896. Price, $2.

The present edition of this list of railroad officers is the fifteenth annual issue and contains the well-known characteristics of the previous volumes.

The chief objection to a list of railroad officers published but once a year is that no matter how carefully it may be edited or how scrupulously it is revised up to the date of publication, constant changing among railroad officers makes a good deal of information out of date by the time the book reaches its readers. A brief examination of the present volume shows how serious is this objection. There is nothing in the book beyond the date of the year to indicate to what time it has been revised, but it has only been received within a few days and presumably was issued late in June. We find, however, that many changes among railroad officers made in April, May and early June are not indicated. Mr. J. D. Layng is given as the General Manager of the West Shore, but not Second Vice-President, to which office he was appointed in April. The present office of Mr. John M. Egan is not shown under the name of his company and the name of the Chief Engineer of the road, who resigned in April, still appears. Under the Lake Erie & Western we notice the name of Mr. H. C. Parker, who died in April, although some recent changes among the superintendents are correctly noted. Mr. J. R. Sample is given as General Superintendent of the Louisville, Evansville & St. Louis, although he resigned early in June. Changes in division superintendents on the Lake Shore & Michigan Southern which occurred early in June are not noted. Mr. Corbin still appears as President of the Long Island road, although his death occurred on June 4. Mr. E. D. Bronner is given as Master Car Builder of the Michigan Central instead of Assistant Superintendent of Motive Power, to which place he was appointed in May. Mr. Dunham is given as General Manager and Mr. Brockenbrough as General Freight Agent of the Ohio Southern, although both resigned many weeks ago. The name of Mr. J. T. Odell, who resigned as Vice-President of the New England in the middle of May, appears as an officer of the company, but not Mr. Clark, the present head of the operating department. Mr. Wallace is given as Chief Engineer of the Chattanooga Southern, although he resigned early in May, and Mr. Bonzano is not noted as General Manager, an appointment made in the same month. Mr. Dodge appears as Traffic Manager of the St. Louis Southwestern, an office he resigned in April. Mr. P. P. Shelby appears as an officer of the Great Northern, at Seattle, although he also resigned in April. Mr. F. W. Fratt resigned as General Manager of the Sherman, Shreveport & Southern in May, but his name still appears on the list. Changes in the superintendents of the Missouri Pacific and the Columbus, Hocking Valley & Toledo made in May are not noted. The address of the Secretary of the Southern Railway, Washington, D. C., is given as New York City. The names of former officers of the St. Louis, Belleville & Southern, the Lima Northern, the Louisville, Evansville & St. Louis and the Marshfield & Southwestern are still continued, although the list of the latter company appears in the "Addenda."

The Engineering Magazine for June contains two articles of especial interest to our readers. The first is by Mr. M. E. Ingalls on "The Turning Point in Railroad Reforms." Mr. Ingalls sketches briefly the rise and development of the railroads and their difficulties. He refers to the enactment of the Interstate Commerce laws and to the work of the Joint Traffic Association. In the course of the article he says: "If the railway business in this country is to be conducted in the future as it was to an alarming extent for, we will say, the two years ending June 30, 1895, those of us engaged in this profession would lose respect for ourselves and of our fellow-citizens and deservedly so." The only apology he makes for these strong words is that "they are true."

The other article is by G. H. Stockbridge on "The Direct Production of Electricity from Coal." The main point touched upon in the article is in regard to Dr. Jacques' method of the direct production of electricity from coal. The process employed by Dr. Jacques consists in chemically combining oxygen with carbon by impregnating a molten basic electrolyte, which is in contact with the carbon, with oxygen or air and collecting the electricity thereby developed by means of an electrode not acted on by the impregnated electrolyte when the circuit is completed. There are some items of expense that are not mentioned by Mr. Stockbridge and which leave us as much as ever in the dark, both as to the actual cost of producing a definite quantity of electricity from a definite amount of coal and the percentage of energy lost by this method of direct production of electricity.

The Press Working of Metals. By Oberlin Smith. Illustrated with 433 engravings. New York: John Wiley & Sons, 1896. Price, $3.

Mr. Smith on his title page describes this work as "a treatise upon the principles and practice of shaping metals in dies by the action of presses, together with a description of the construction of such implements in their various forms and the materials worked in them." The elementary forms of presses are first given, presses being classified by their motions, position, frame design, etc. Engravings and brief descriptions are given of presses designed for all the different processes for which such tools are adapted. Then dies are taken up in much the same way. Having thus systematically covered the ground the author devotes a chapter to each of the following processes: Cutting, bending, curling, seaming, drawing, redrawing and coining. The processes are described at considerable length from the standpoint of a man who has had a great deal of experience in their practical application. The method of treatment is quite elementary and in style "adapted to the meanest comprehension," as the phrase goes. The book is practically without mathematical investigation, although the author goes at some length into the method of determining the dimensions of blanks for a given work. The presses and methods treated of are confined pretty closely to light work, and we find little that would be of much use to those who are engaged so extensively now in producing heavy pressed-steel shapes. Within its limits, however, the book is comprehensive, detailed, and, what is almost as important, interesting.

American Street Railway Investments. Published annually; edition of 1896. New York: The Street Railway Publishing Co. Price, $3.

The third annual edition of this work is somewhat larger, naturally, than the second, but otherwise shows no important changes except that the balance sheets and operating statistics are given for four years instead of for three. Financial reports are given of 927 operating companies, 185 leased companies and 307 new corporations. The municipal statistics of nearly 700 cities and towns are also given. The publishers ask especial attention to the official character of the data. Out of 1,112 operating and leased corporations, of which reports are given, only 8⅛ per cent. have not been heard from officially, and the entire work is corrected to May 31, 1896. The scheme of the work is to give in brief form the history, capitalization and debt of each company; statements of the results of operation, description of the plant and equipment and names and addresses of officers. An interesting feature of the book is the considerable number of maps, and the large size of the page makes it possible to give these on such a scale as to be legible and of some practical use. The information is conveniently arranged, the cities of the United States being given alphabetically and the essential facts are presented in compact shape.

Steel in Construction. Philadelphia: Pencoyd Iron Works, A. & P. Roberts Co., 261 South Fourth street.

This is the ninth edition of the handbook published by the Pencoyd Company giving rules, formulæ and tables for the strength of steel shapes used as beams, struts, shafts, etc., and made by the Pencoyd Iron Works. The last edition, the eighth, was published in 1892. Since that time the manufacture of wrought iron has been abandoned at Pencoyd and the whole product of the plant has been changed to open-hearth steel. Several undesirable sections have been abandoned and others substituted with an aim to standardizing wherever possible. Therefore a new edition had become necessary and it is confined entirely to the output of the Pencoyd Works. The text and the tables have been prepared under the supervision of Mr. James Christie. The book contains 232 pages besides the alphabetical index and 30 plates of Pencoyd sections. The tables give dimensions, weights and elements for all the different standard shapes rolled at the Pencoyd Works and the designer knows how essential to his work such information is. There is other useful information of a more general nature such as a chapter on stresses in framed structures and on steel and iron shafting.

TRADE CATALOGUES.

Acadia and Thereabouts, by Frank Presbrey, is a little pamphlet of 40 pages issued by the Plant System, which runs passenger steamers to Nova Scotia and Prince Edward's Island. The descriptive text is good and the pages are crammed full of pictures—there must be two or three hundred of them. They are direct process, from photographs, and appear to be all new. Most of them are pretty small, a necessary result of putting in so many, but one may get from them alone a good idea of the country and need look at the text only for historical notes.

The Buffalo Forge Company, of Buffalo, N. Y., has issued a handsome catalogue for 1896. It contains a description of the plant and various engravings showing the different types of engines built. Horizontal automatic engines with single cylinders are built in both side and center crank forms, being especially designed for dynamo work. The center crank engines have all rubbing surfaces enclosed and running in oil. Upright engines with both single and double cylinders are shown. Also their steel plate steam fan for producing mechanical draft.

The Cleveland Twist Drill Co., of Cleveland, O., has issued a catalogue for 1896 which is attractive and complete. It is of the standard size, 7 in. × 9 in., and contains 62 pages, in which are represented by engravings the numerous twist drills manufactured by the company. Together with these cuts is presented a price list and complete particulars for each tool. Besides the drills the catalogue shows reamers, gages, milling cutters and steam drills which are manufactured by the company. The book will be sent to any one desiring it, if a written request is sent to the company.

Automatic Car Couplers and Draft Riggings.—We are in receipt of the 1896 pamphlet of the Springfield Malleable Iron Co., in which are given in more or less detail the Ludlow automatic freight car coupler, the Ludlow automatic passenger car coupler, the Miner draft rigging and the Bryan draft rigging. The malleable castings of which the attachments to these riggings are made are

carefully annealed, and have a tensile strength of 44,000 lbs. per square inch.

Indestructible Steel Cars and Steel Underframes.—The Universal Construction Company, whose works are at 50 Wabansia avenue, Chicago, has issued a 40-page pamphlet dated June, 1896. It contains 14 engravings of the steel cars of the same type as were illustrated and described in the *Railroad Gazette* of June 12. These cars were exhibited at the Master Car Builders' and Master Mechanics' conventions at Saratoga.

The Buckeye Malleable Iron & Coupler Co., of Columbus, O., issues a 32-page pamphlet dated June, 1896, which shows the "Little Giant" coupler by detailed cuts and also as it appears on passenger cars. In connection with this is shown in detail the "Little Giant" Buckeye shank, for passenger equipment.

The Hancock Locomotive Inspirator.—The Hancock Inspirator Co., of Boston, have brought out their pamphlet for 1896, in which they show in detail the parts of the inspirator and also a sectional view of the same.

Disastrous Rainstorm at Wheeling.

A rainstorm on Monday last, at Wheeling, W. Va., did great damage to railroad property in that vicinity. The storm covered an area of about 20 miles square, and lasted fully an hour, the rain falling throughout that time in torrents. At Wheeling, the piers and abutments of the Baltimore & Ohio bridge over Wheeling Creek, a structure rebuilt a few years ago, gave way, and the freight sheds, tracks and a part of the freight house which is located on the creek bank, fell into the stream. At Moundsville the bridges of the Baltimore & & Ohio and Ohio River roads, over Little Grave Creek, were washed out, and the Baltimore & Ohio tracks for three-fourths of a mile, including one wooden bridge, were washed away. At the "Narrows," about half way between Wheeling and Moundsville, an immense landslide came down from the hill and pushed the Ohio River, Baltimore & Ohio, and electric railroad tracks far out of position, and covered them with rock and earth to a depth of several feet.

On the Ohio side of the river, the roadbed of the Bellaire, Zanesville & Cincinnati Railroad was completely washed out for two miles along Wegee Creek. Every bridge and trestle along that distance was destroyed, The Pittsburgh, Ohio Valley & Cincinnati Railroad (Pennsylvania) was washed out at several points between Bellaire and Clarington.

The Baltimore & Ohio had to run its through trains by way of Pittsburgh, the road between Benwood and Moundsville being closed entirely. The Ohio River Railroad has chartered a steamboat and is using it to carry passengers, mail and express from Wheeling to Moundsville, 12 miles. The officers expected to have the road open in three days.

Locomotive Rating and Fuel.

(*Continued from page* 489.)

not think he does, and I believe he will find that in taking up the coal question it is absolutely necessary that the operating department and the mechanical department work together. As a rule, I think that the subject of fuel consumption is not considered enough in the operating department. On railroads that have coal mines located along their line of road, the mines have to be developed. If they do not get the patronage of the railroad they are not very apt to get the patronage of anybody else.

The author says he does not believe in the premium system. "It too often results to the advantage of a few men only and has very little interest for the rank and file." We have no premium system on our line, but it does seem to me that recognition of good service is something that you never lose anything by. We know that in all public services a system of rewards and merits is regarded as in the proper line.

MR. WM. FORSYTH (C., B. & Q. Ry.): I regard this paper of Mr. Lyon's as one of the most useful of any that have been presented to the club during this year. It is really a complete treatise upon the subject of rating locomotives, and I should think that any road, that wanted to take up the tonnage basis would find it the best general book of instructions they could obtain on the subject. It deals directly with train resistance and Mr. Lyon says that the calculation of the power of the engine by the ordinary method does not apply very well in rating engines. Neither has the attempt to use a dynamometer car been very successful as applied to this new practice. I had some experience in that direction. When we first went at the rating of engines by the tonnage basis we tried to obtain the difference in resistance of empty cars, partially loaded cars and fully loaded cars, both on grade and on a level, and I have here some figures which we obtained. I may say, first, that it has been considered that the grades were the limiting points on the line, or, rather, that the grades limited the size of the train, but I think that with the increase of speed of freight trains above 30 and 35 miles an hour, that that is no longer the case, that speed is now becoming the limiting element, and an engine that can get a long freight train up a one per cent. grade, will find equal difficulty in maintaing a speed above 25 miles an hour on a level. The figures that have been given for train resistance generally have been obtained for short passenger trains, and when you get figures for train resistance for long freight trains it soon becomes apparent how much influence the length of the train has on the resistance. In our experiments on grades, at a speed of 10 miles an hour, the resistance of long trains and short trains was very nearly the same, that is, the bulk of the resistance was due to the grade, and it showed also that the journal friction was about the same—journal friction and wheel friction, as we might naturally expect, for long trains or short trains. We found on a level at 25 miles an hour the resistance of 59 empty box cars was 20 lbs. per ton and of 30 empty box cars 24 lbs. to the ton. Of 18 loaded stock cars the resistance was 13 lbs. per ton; when one-third loaded it was 19 lbs. per ton, and of those same cars empty the resistance was 21 lbs. per ton. That was also the same for 21 empty box cars—the resistance was 21 lbs. per ton. Now those figures, I think, are very nearly correct, and they show that the ordinary figure which is assumed for train resistance must be largely increased for long trains and for speeds which exceed 25 miles an hour.

The conclusion which we came to as the result of our experiments in rating empty and loaded cars was somewhat different from Mr. Lyon's, but it is likely that his figure is more nearly correct. He assumes that resistance of empty cars is one-third greater than loaded cars, or as 8 to 6 lbs. Our first conclusion was, that on grades of one per cent or more, when the speed is low, the pull per ton of a train of heavily loaded cars, and a train of empty cars of the same approximate weight, *is practically the same.* Second, on a level, where speed is increased to 25 miles an hour or the wind resistance is increased, the difference in pull per ton of a train of heavily loaded cars and a train of equivalent weight of empty cars *is very great.* Hence, for grades not exceeding one per cent. the number of cars for a train of empty or lightly loaded cars is governed by the resistance imposed by speed on a level; while the rating for trains of heavily loaded cars is governed by the ruling grade. As the grade of any division exceeds one per cent. the factor of resistance due to grade becomes more important, while in proportion as the ruling grade amounts to less than one per cent in that proportion do the other factors of speed and wind become more important. As a preliminary rating for trial we recommended for empty cars to add 50 per cent. to their weight; for cars having one-third loading 30 per cent to their weight; cars having two-thirds loading 10 per cent. I am not sure whether these figures will apply directly for engine rating, but relatively they are nearly correct.

Mr. LYON, in addition to train rating, comes to rating of the engineer and fireman, and shows that, with the more accurate data, he is able to distinguish the good men from the poor, and while he does not believe in the premium system he still has a system of good marks, which the men evidently regard as something valuable. I have often thought that in making those marks, or giving men credit for good work or reproving them for poorwork, that they would appreciate the record more if the figures were given in dollars and cents instead of pounds of coal. Mr. Lyon's record shows how much in pounds an engineer burns in excess of what he should have burned. Now if his record would show that an engineer had burned $15 worth or $25 worth more coal per month than he should have burned, I think it would appeal more directly to his sense of how much injury or how much good he has done the company and how much the company appreciated him or depreciated him for that work.

There is a paragraph concerning the relation between passenger trains and freight trains which I do not exactly understand, and which I hope Mr. Lyon will explain, and also give us, if possible, just the difference in pounds of coal per ton hauled for passenger trains and for freight trains

Mr. C. H. QUEREAU (B & M. in Neb.): On the Burlington & Missouri we have been operating for some months on the tonnage basis system, and I wish to confirm and praise what has been given in this paper, as far as practical results are concerned.

As an illustration of the way the tonnage rating has affected the loading of engines, on one division where the terminal point is approximately in the center of the division, the average loaded freight train was about 16 cars previous to the use of the tonnage rating. The superintendent was very sure that that number of cars could not be increased. His division point was in the center, and he received small trains from a number of branch lines. The chief shops of the system were located on his division; he had to run engines light going from the repair shops to the other divisions, and he was very confident that every effort had been made to increase the train loading. But the first month after the tonnage rating was put in force, and since then, the average number of loaded cars on his freight trains has been over 19 or an increase of almost 20 per cent. was thus made in spite of the fact that he was very confident that every effort possible had been made to increase the rating. The same thing is true on other divisions. On one division which is some 700 miles long and has few branches, the number of trains has been reduced and the average number of loads on the train has been increased, though not in quite so large a per cent., and that has been the result everywhere on the system. This, of course, conduces to a better fuel performance, and as a result, partly of this and partly of other measures, our fuel consumption has improved considerably.

I would like to say just a word as to the relative influence of the operating department and the mechanical department upon fuel consumption. Aside from the quality of the coal used, it seems to me there are four principal items which affect fuel economy which are subject to control. One is the speed of the train, another is the weight of the train, another is the efficiency of the enginemen, and another the efficiency of the engine considered as a machine Any improvement in fuel economy which will come from the increased efficiency of the men must be very gradual. We know that no one can go through a college in a week, and no one can acquire new habits, more economical habits and greater skill in handling his locomotive in a short time, so that any increased economy due to the betterment of the service of the enginemen must be gradual. The same thing is true so far as the design of the boiler or engine is concerned. We may improve the heating surface and enlarge the grate; we may make what changes we wish in the design of the locomotive, still the effect must be very gradual, because we cannot change our engines all at once: it will take years to get the improvements on all our engines. But the superintendent of the operating department can, by a stroke of the pen, by adjusting the load of the locomotive, or by so distributing the time on the time card that the engine may work to the best advantage, make a wonderful saving at once. It does seem that the greatest influence on our coal consumption must come from the operating department, and at the same time, as has been well said in this paper, there is no one who knows better how to make a fuel saving than an officer in the mechanical department; so that it seems to me, for the best results, it is essential that the operating department and the mechanical department co-operate thoroughly and heartily.

President POTTER: Mr. Lyon has made an allowance for the rolling friction or the journal friction or both for the cars, which he states to be about six pounds per ton, and as I understand from the paper the efficiency of the men is determined, in a measure, by their performance as to the amount of coal they used for doing a given work, I would like to ask him if he has made any calculation for the coal consumed by the engine. To illustrate what I am trying to bring out: A consolidation engine will use about 30 lbs. of coal per mile alone, The engine running alone will use about that amount. The same engine, hauling a full train, will use from 100 to 125 lbs. Now with the limit fixed on the amount of coal used in hauling a full train, if an engine was given a small train, the amount of coal used per unit, be that ton or car, will increase very materially, while the man may have handled his engine just as economically and carefully as he would have done if he had had a full train, so that unless a provision of that kind is made, it seems to me you are liable not to get the best results, and in a system so thoroughly worked out as this outlined in Mr. Lyon's paper, it would seem that some improvement would be obtained by going still further, and making an allowance for the coal consumed by the engine.

Mr. TRACY LYON: In regard to the point brought up by Mr. Porter, I will say that, in the first place, we do not expect to run small trains—that it is a very rare occurrence for an engine to leave the terminal point in the direction of greatest traffic without having its full rating. Secondly, such a difference in rating is equalized to a certain extent by our coal allowance; that is to say, the amount of coal which we allow a man running on a time freight is not the same as though he were running on a way freight. If he has a stock train, for instance, he is expected to make comparatively high speed, and he is allowed for this work more coal per ten thousand ton miles than he would if he had a heavy train and was expected to make less speed. I appreciate Mr. Potter's point, but, in the light of our experience, I really think that it would be rather hard to make such an allowance which would be consistent. I do not mean to say that our methods are perfect, by any means, but if a man has a light train at one time, he is very likely to have a heavier train at another, and these things average themselves to a certain extent.

President POTTER: It is altogether likely that for the purpose of rating engines, that is a refinement it is hardly worth while going into. On our line we are endeavoring to start the coal premium system on the tonnage basis, and we found that it was necessary to bring about the results we desired, to work the scheme out in such a way that no matter what the conditions were as to size of trains and so forth, it would be fair under all those conditions.

Mr. LYON: The wheel resistance of a loaded car of 6 lbs. per ton which I refer to is supposed to represent the resistance at minimum speed and from the point of view of getting over the hills irrespective of time.

Mr. Forsyth asked about my statement that the average consumption of coal per ton-mile of passenger trains over that of freight trains had increased from 28 to 45 per cent. in consequence of changes in schedule made during the last few months. I mean by that that at one time the consumption of coal per ten thousand ton-miles of passenger trains (this is taking the whole road as an average) was greater than the consumption per ton-mile of freight trains by 28 per cent and that this increment has increased by reason of external causes to 48 per cent. The causes I mentioned were not only increases in speed by the time card, but, as it happened in this case, an order requiring slow speed over switches, which increased the speed still further between stations, the difference in coal consumption being remarkably evident.

Mr. C. H. QUEREAU: There is one point I think worth mentioning that has not been touched on—the effect of a tonnage rating on the number of hours' delay due to engine failures. Since the tonnage rating has been put into effect the number of engine delays has been reduced wonderfully with us, as much as 50 per cent. on one division. I believe this is due to the decrease in overloading.

Railroad Matters in England.

Accident Returns.—In connection with the accident returns for 1895, the *Railway Review*, the organ of the largest and most important railway trade union, calls attention to the remarkable discrepancy between the figures for the different companies. The four largest English railways are the North Western, the Great Western, the North Eastern and the Midland. On each of these the number of railway servants killed in the year was between 40 and 50. But whereas on the three lines first named the injuries reported ranged between 337 and 578, on the Midland the number was only 88. In other words the first three companies return nine injuries for one death, whereas the Midland returns only a little over two. These discrepancies are no new thing. A year or two back it was made manifest that different companies took different views of the meaning of the word "injury." The Board of Trade appointed a committee to go into the question, and it was supposed that in future the practice of the companies would become uniform. That it has not, however, done so, is, I think, obvious from the figures given above, to which indeed others equally striking might be added. For example, the Great Eastern has 30 servants killed and 55 injured. The Great Northern, with much the same length of line and somewhat similar traffic, has 22 killed and 127 injured. A similar contrast might be drawn between the South Western and the Brighton, whose circumstances are very similar, though the Brighton mileage is only about half that of the South Western. The Brighton has 15 killed and 30 injured—proportion 1 to 2; the South Western 18 killed and 104 injured—proportion 1 to nearly 6.

The *Railway Review* quotes these figures with the object of discrediting the London & North Western, a company which has always been very unpopular with the trade union officials on account of its alleged arbitrary and high-handed conduct. In particular it has taken a very strong line on the question of employers' liability for accidents. On the North Western practically the whole staff have signed agreements—under compulsion, say the trade union officials—binding them not to sue for damages in case of injury through the negligence either of the company or of fellow employees. In return the company subscribes handsomely to the men's insurance funds. On the Midland, however, the men are left free to seek their legal remedies wherever they choose to do so without the company's subscription to the accident funds being in any way curtailed on that account. I have given the trade union contention. It is therefore only right to add that the *Review's* own figures by no means bear the contention out. For, as has been said, the Brighton percentage of injuries is quite unusually low; yet on the Brighton, as on the North

Western. the whole staff habitually contract out of their legal rights. The South Western is a company which has always treated its men with exceptional liberality, and where the utmost harmony prevails in all ranks of the service. Yet its percentage of injuries seems, when compared with the Brighton, quite abnormally high.

Conveyance of Farm Produce.—The reduction of rates for the conveyance of farm produce still goes on and interesting new developments continue to occur from time to time. It has become abundantly evident that the British farmer will not attempt to do his business in an economical wholesale manner. The cheap rates for the conveyance of agricultural produce and necessaries in truck-load quantities have been, however, at once made use of by the corn dealers and the artificial manure manufacturers to a large extent. But, undaunted by their failure to induce the farmer to adopt modern methods, the railway companies are doing what they can to encourage his retail traffic. The Great Eastern, for instance, has printed two books—the one a list of farmers in its district who are ready to supply boxes of fruit, vegetables and dairy produce and intended for circulation among the company's season ticket holders in London and the suburbs, the other a list of names and addresses of the season ticket holders and intended for circulation among the farmers. The South Western has put in force exceptionally low rates for the carriage of produce in consignments of 1 cwt. and upward, including delivery to the consignee in London. These rates are in two classes for the cheaper and more expensive kinds of vegetables respectively. Below I give in tabular form a few average instances.

Station.	Miles from London.	Rates per cwt.	(including delivery).
Bookham	20	7d.	9d.
Godalming	34	8d.	10d.
Farnham	37	10d.	1s. 0d.
Porton	78	1s. 0d.	1s. 3d.
Wimborne	113	1s. 3d.	1s. 6d.
Honiton	154	1s. 8d.	2s. 0d.
Okehampton	197	1s. 11d.	2s. 3d.
Torrington	225	2s. 0d.	2s. 4d.

Considerable as the reduction has been in actual rates it may be questioned whether the most important effect of the movement has not been indirect rather than direct. Hitherto the average English farmer seems to have believed that the low rates by the English railways for foreign produce were given mainly in order to injure him "out of pure cussedness." In the last few months the farmers' representatives have been to an extent unknown before brought into personal contact with the leading men in the railway service. The two sides have frankly interchanged their views and have discussed their differences with good temper and a sincere desire to come to some agreement, reconciling, if possible, the conflicting interests of both. If these conferences should gradually develop into something which might take in an informal manner the place occupied by the official railway councils (Eisenbahnräthe) of Prussia and other continental countries it would be a very good thing for England.

W. M. ACWORTH.

The Wolstencroft Pneumatic Tool.

The engravings show the Wolstencroft pneumatic tool, made by Wm. Wolstencroft's Sons & Co., Frankford, Philadelphia, Pa. A large number of these are in use and the company is enlarging its plant, more than doubling its capacity.

In operation, pressing the throttle, *A*, toward the work opens the air valve (see Fig. 2) in which position the air is allowed to enter the cavity, *C'*, through the two inlet passages shown and thence through the ports, *D*, in the valve, *F*, to the valve chamber, *E* and *E'*, behind the hammer, *G*. This forces the hammer forward, striking the stem of the calking or beading tool direct and also causes a backward movement of the valve, *F*. The backward movement of the valve, *F*, closes the admission of air through *D* to its interior and opens an exhaust through *M* and *M'*; at the same time the duct, *K*, in the hammer, *G*, is uncovered by *F*, admitting air to the chamber, *L*, in front of the hammer, which is thereby thrown back, allowing air to exhaust through the port, *N*. The return of the throttle valve is controlled by a cushion of air, acting upon its inner end, so that when the pressure of the operator's hand upon the throttle, *A*, is released, the valve will be automatically moved to close the passages communicating with the chamber, *C'*, the movement of the valve being limited by the stop pin, *P*. *C C C* is the casing; *H*, hardened steel stationary bushing. and *I I* are wood fiber washers.

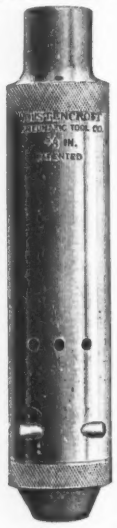


Fig. 1.

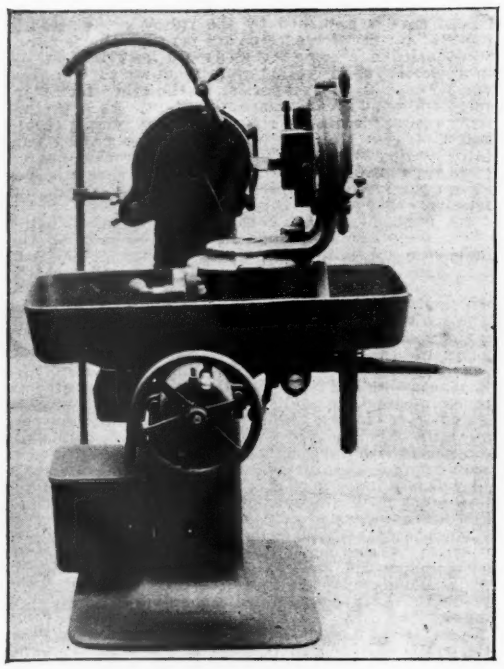
An interesting feature of this tool is the simultaneous movement of the valve and hammer in opposite directions, reducing jar or vibration to a minimum, as the movement has a tendency to counterbalance and equalize the action of the parts.

The company also makes pneumatic tools for riveting and chipping all kinds of metals and cutting and carving stone and granite.

Universal Tool Grinding Machine.

The universal grinding machine which is made by the Grisholt Machine Company, of Madison, Wis., an engraving of which we show, has four main structural parts as follows: 1. A column in which the emery wheel arbor is journalled and through which is forced the heavy circular arm on which the pan oscillates. 2. An oscillating pan supporting the tool holder and having a transverse motion on the arm. 3. A tool holder provided with a tool clamp and graduated circles, by means of which the tool may be made to assume any desired position with respect to the emery wheel. 4. A tubular emery wheel mounted on an arm about which the pan oscillates. As grinding takes place on the side face of the emery wheel flat surfaces may be ground by oscillating the pan by means of the hand lever at the right of the machine.

The arbor is made of crucible steel and fitted to the long bronze boxes by scraping. The boxes are tapered on the outside and are adjusted by nuts on either end



Universal Tool-Grinding Machine.

A very substantial end thrust bearing is provided at the outer end of the spindle. The pan is arranged with a lever fulcrumed on its lower side, by means of which it may be oscillated through a limited arc in a plane at right angles to the emery wheel arbor. The arm on which the pan oscillates is forced into the frame and is provided with a hand wheel, as shown in the figure, and with a feed screw for moving the pan in and out from the frame. The tool holder is fitted to the upper surface of the pan so as so slide in a direction parallel to the arbor, and a tool held in the clamp may be moved about four different centers. It may be moved 30 deg. either side of the center line, rotated either through the full circle about its own axis as a center or through about 320 deg. in a horizontal plane and the entire tool holder may be rotated in the base to the amount of 15 deg. on either side of the horizontal. A chart to guide the mechanic in grinding lathe and planer tools is sent with the machine, giving the angles at which to set the different movable parts for grinding the sides and ends of any kind of tools used in shop practice. The machine is well adapted for grinding both thread tools and special tools.

TECHNICAL.

Manufacturing and Business.

The Seymour Mfg. Co., of Seymour, Conn., is enlarging its boiler house, and the new portion of the building will be constructed entirely of steel by the Berlin Iron Bridge Co.

Iron and Steel.

The Bethlehem Iron Co., of South Bethlehem, Pa., is now ready to roll plates from high-grade open-hearth steel on its new plate mill, the rolls of which are 126 in. in length. Its product in this line will consist of plates for all purposes, which includes ship plate, boiler plate, tank, stacks, etc.

The new engine which has just been installed at the iron and steel works at North Tonawanda, N. Y., was designed by Julian Kennedy, and built by the Lake Erie Engineering Works of Buffalo. The engine weighs 600 tons; the flywheel alone weighs 55 tons and makes 50 revolutions per minute; the shaft is 22 inches in diameter. This is the first engine of its type ever built in the United States.

The Burden Iron Company of Troy, N. Y., has elected directors as follows: James A. Burden, I. Townsend Burden, John L. Arts, James A. Burden, Jr., and Nicholas J. Gable. The officers are: President, James A. Burden; Secretary, N. J. Gable.

The Jefferson Steel & Mfg. Co., at Birmingham, Ala., is making extensive additions and improvements to its plant. A 15-ton Hawkins furnace is being put in, and it is expected to go into blast about July 15, Mr. F.W. Hawkins, of Detroit, being in charge. If the new furnace is satisfactory, it is expected to erect nine more of the same pattern as soon as practicable. The combined capacity of these new furnaces will be about 400 tons of ingots and slabs per day.

The Carnegie Steel Co. has contracted with the Westinghouse Electric & Mfg. Co. for a complete electrical equipment for its Duquesne works. Electrical power will be used for driving all light cranes, and it will probably be also employed in driving the rolls. Sixteen large dynamos will be installed at first, but it is expected subsequently to increase this number.

The Chartiers Iron & Steel Co., of Pittsburgh, Pa., is adding a No. 3 pickling machine to its plant.

Extensive improvements are being made by the Oliver Iron & Steel Co. at its Southside plant in Pittsburgh. The old Clapp-Griffiths open-hearth is to be replaced by a Bessemer plant; a blooming mill of modern type will be put in, and the galvanizing department is being enlarged to almost double its present capacity. The continuous mill, which has just been completed, has been found to work satisfactorily.

The Bethlehem Iron Company's rail mill, at Bethleham, Pa., has been shut down for an indefinite time, on account of the lack of orders. About 1,500 hands have thus been thrown out of work.

The mines of the Metropolitan Iron & Land Co., at Ironwood, Mich., were closed on July 3. This has thrown fully 1,500 men out of work. The company has at present in its stock piles about 500,000 tons of ore, about half the yearly output of the mines, and the sales so far this season have only amounted to about 100,000 tons.

New Stations and Shops.

It is announced that the Grand Trunk is to build a fine new passenger station at Portland, Me. Negotiations are in progress which it is expected will result in the company securing possession of the Curtis shipyard at East Deering, adjacent to the Grand Trunk tracks. It is the intention of the company to construct a new round house and coal sheds upon the property.

The Philadelphia & Reading will build a new freight house at Reading, Pa., to be 40 ft. × 60 ft.

Foreign Electric Railroads.

The Dublin Southern District Tramway Company opened its electric line to the public on May 9. The line is double track throughout the entire length except for a short distance in one of the narrow thoroughfares. The gage is 5 ft. 3 in., the rails are of the girder type weighing 75 lbs. per yard, joined by fish plates weighing 25½ lbs. per pair and rest upon a bed of concrete 6 in. thick which extends over the entire street. The overhead construction is the span trolley system, the supporting standards being of hollow steel tubes. The generators are in a central power station and in two sub or supply stations. The central power-house is equipped with two 500-volt generators driven by four engines each capable of giving 150 H. P. The carrying equipment consists of a motor car with a capacity to seat 53 passengers drawing a trailer having a seating capacity of 46. The motors are supplied by the General Electric Company.

A company has been organized for the purpose of constructing an electric railroad from Zermatt up to Gornergrat, Switzerland. This eminence is about 10,500 feet high, and is a well-known point for obtaining a fine view of the surrounding Alps. This railway will be six miles long and will have an average grade of 15 deg. and a maximum grade of 20 deg. Each train will consist of two cars and, it is stated, will carry 100 passengers.

Versailles, France, is to have an electric street railroad, and it is stated that within two months the horse cars will give way to the new system. The power will be supplied from the light and power station at Versailles. The steam generating plant will consist of four semi-tubular boilers, supplying steam to four horizontal single-cylinder engines, aggregating 350 h. p., for the light and power service in the city, and two steam engines, aggregating 240 h. p., for the street railroad. The electric generating plant will consist of two General Electric dynamos, aggregating 250 kilowatts, and two direct-

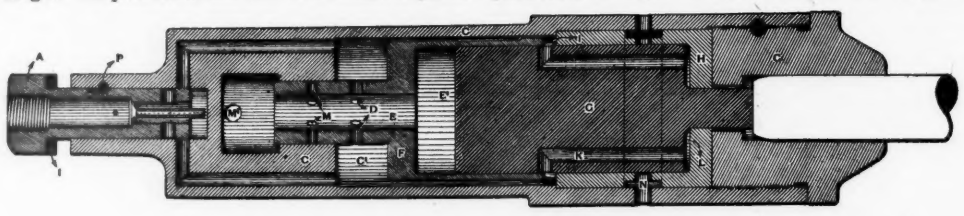


Fig. 2.—Sectional View, Wolstencroft Pneumatic Tool.

coupled railway generators aggregating 200 kilowatts. The rolling stock will be 15 cars.

More Coupler Tests.

We have received the following report of a coupler test made at the works of the Whiteley Malleable Castings Co., at Muncie, Ind., June 30th, 1896. The table given below shows the result of a series of tests made on 14 malleable iron American couplers which were taken from a lot of 1,000 ready for shipment at the works of the Whiteley Malleable Castings Co., Muncie, Ind. The tests were made by Mr. I. G. Reading, representing Messrs. R. W. Hunt & Co., of Chicago, Ill. The M. C. B. specifications require three blows at 10 ft. and two blows at 15 ft., using standard 1,640 lb. hammer; these couplers averaged three blows at 10 ft. and 7 1/14 blows at 15 ft.

1.	3 blows at	10 ft.	6 blows at	15 ft.		Bar bent but not broken. Fracture good.
2.	3 "	10 "	8 "	15 "		Bar cracked in liner block, not broken. Fracture good.
3.	3 "	10 "	7 "	15 "		Knuckle broke.
4.	3 "	10 "	5 "	15 "	"	
5.	3 "	10 "	5 "	15 "		Head broke out at back wall. Fracture good.
6.	3 "	10 "	7 "	15 "		Stem broke under head. Fracture good.
7.	3 "	10 "	7 "	15 "		Head broke off under stem. Fracture good.
8.	3 "	10 "	7 "	15 "		Stem broken. Fracture good.
9.	3 "	10 "	7 "	15 "		Split through liner block-head, not broken. Fracture good.
10.	3 "	10 "	6 "	15 "		Split through liner block. Fracture good.
11.	3 "	10 "	10 "	15 "		Stem broken under head. Fracture good.
12.	3 "	10 "	10 "	15 "		Broken at liner block. Fracture good.
13.	3 "	10 "	6 "	15 "	"	
14.	3 "	10 "	8 "	15 "		Liner block cracked, bar not broken. Fracture good.
			99			

Average blows at 15 ft., 7 1/14 blows.
Average number of feet to each coupler, 136 1/14.

Effect of Temperature on Insulating Materials.

The following are the conclusions drawn by Charles F. Scott, of the A. I. E. E. from the results of a series of tests in order to determine the effect of temperature on insulating materials:

First. The insulation resistance of all ordinary fibrous insulating materials, such as paper, cloth, etc., decreases upon being heated up and then increases again when the moisture is expelled.

Second. Continued heating of thirty-one hours at 120 deg. C. does not lower the insulation resistance of paper.

Third. The insulation resistance of completed apparatus shows the same characteristics as the insulation resistance of materials taken separately.

Fourth. A low insulation resistance is not necessarily an indication of poor insulation, but probably an indication of the condition of the apparatus in regard to moisture.

Fifth. A high e. m. f. should not be applied to apparatus when the insulation resistance is low.

Sixth. Material which is badly deteriorated mechanically by heat may still have a high insulation resistance, but very poor insulating qualities.

The Tests of Fire-Proofing Material.

In the *Railroad Gazette* of Aug. 16, 1895, we spoke quite fully of the arrangements which had been made for testing structural and fire-proofing materials under the direction of a committee selected by the fire insurance companies, the architects and the engineers. This committee was composed of Messrs. S. A. Reed, representing the Tariff Association of New York; G. L. Hines, representing the Architectural League of New York; H. de B. Parsons and Thomas F. Rowland, Jr., of the American Society of Mechanical Engineers. The building and plant are completed and a few tests have already been made at the Continental Iron Works in Brooklyn. On June 30 a pillar of cast iron made by the Cornell Iron Works, of New York, 13 ft. long, 8 in. outside diameter and 6 in. inside diameter, was tested. A pressure of about 70 tons was applied and the room in which the test was made was heated until the column was at red heat. During the heating no change was observed to take place in the column, but as soon as the high temperature was reached the pillar began to fail quite rapidly and the pressure was kept constant for about half an hour. At the end of that time it was bent out considerably in a bow shape in one direction below the middle of the column, and in the opposite direction in the upper half. The results of these tests will be given in full when they are made public.

Two Proposed Methods of a Third-Rail Equipment.

The Bridgeport Car Equipment Co., of Bridgeport, Conn., exhibited at the Master Car Builders' and Master Mechanics' conventions a complete working model of a steam railroad equipped with switches, curves and street crossings. The model of the car which they exhibited ran forward and backward with no dead ends or stoppage from any cause. The third rail consists essentially of two rails placed one above the other and held apart by a flexible steel tube. The top rail, which is depressible, is "dead" except when the trolley wheels depress the depressible rail into contact with the live rail or conductor contained within the water-tight flexible tube. As the car passes by the top rail rises from the "live" rail and becomes "dead" again. The conductor is thoroughly isolated from the exterior. The steam railroads which use this system need not bury the third rail, but at the crossings the third rail must be inclosed by rolled iron protection plates.

A plan similar in some respects to the above has been invented by two Englishmen, Messrs. Pringle and Kent, and is described in *Engineering* of June 19. The current is conveyed to the cars by means of a center rail which is practically at the surface level of the street and is "alive" for only the length which is under the car. The track is divided into sections of 135 yards, and each section is subdivided into 24 sub-sections of 16 ft. For each section there is a distributor from which there run 24 cables, one to each sub-section, and as the car proceeds, each of these 24 cables is successively placed in connection with the main cable from the power house, and conveys current to a short length of surface rail, from which it is taken by a rubbing contact to the motors on the car, and through them to the rails as a return circuit. As the car enters a sub-section the distributor switches the current on to that sub-section, and cuts it off from the previous one.

THE SCRAP HEAP.

Notes.

A fire on the wharf of the Mallory Steamship Line at Galveston, July 2, destroyed 5,000 bales of jute, large quantities of other freight and 26 cars. Loss $200,000.

The Buffalo Grade Crossing Commissioners have signed a contract with the New York, Chicago & St. Louis Railroad for the changes in grade to be made on the line of that road in the city.

At the general offices of the Pennsylvania Railroad in Philadelphia the room set apart for the bicycles of the clerks now receives about 200 each day. At a similar room in the office of the Philadelphia & Reading there are stands for 150 bicycles.

The Chicago show collision came off July 4 as advertised, though the spectators were kept waiting an hour and a half. The reporters estimate that the crowd numbered 25,000. The speed of the engines just before they met is said to have been 45 miles an hour. The collision took place in Cicero, but the engines came from the Illinois Central.

The United States Appellate Court at Chicago has affirmed the verdict of a lower court in the case of Herbert Gehr against the Mexican Central Railway for $40,000 damages for alleged false imprisonment. In 1887 Gehr was an employee of the road and was arrested and imprisoned in a filthy jail, charged with stealing a package containing $8,000.

The New Transatlantic Service to Canada.

It is impossible, at the present time, to obtain any information with regard to the tenders [for the new ships] from official sources, even so far as the total number received is concerned. It is understood, however, that in several cases shipbuilders will assist the tenderers in finding the money required. The service is to be weekly from Liverpool to such other English ports as may be agreed upon, to Quebec in summer and Halifax in winter. A call must be made at an Irish port, which has yet to be named, but no foreign port will be touched. At one time there was an idea of including a French port in the round trip, with a view to developing trade between Lower Canada and France, but now that an agreement has been arrived at for a fortnightly direct service between Canada, France, and Belgium this is unnecessary. They are—and upon this depends the Government subsidy—to be built as Admiralty reserve cruisers, and they are to be of not less than 8,500 tons gross, with a speed of 20 knots. They will have accommodation for 275 saloon, 200 second cabin, and 1,000 steerage passengers, and they will be fitted with refrigerating plant and cold storage. The conditions are that the service shall be commenced in May, 1898, and as this leaves only 22 months from now for the completion of the vessels, the Canadian authorities ought to lose no time in arriving at a decision with regard to the tenders.—*Transport.*

Thefts on Italian Railroads.

According to the British Consul at Genoa, thefts from the baggage of passengers are so common on the railroads of Italy as to cause much annoyance, and passengers who suffer losses find it impossible to get any satisfaction. Schemes for having trunks corded and sealed have been much discussed, but nothing has been done, and it is said that the thieves have acquired such skill by long experience that they abstract articles from a trunk without damaging it. The railroad companies refuse to pay claims for articles of value in trunks, taking advantage of the law which relieves them from responsibility for such articles.

Lake Notes.

At Chicago the other day the steamer Maricopa, of the Minnesota Steamship Co., to run in the ore trade between Duluth and Lake Erie ports, was launched. She is 406 ft. keel length, and is of about 6,000 gross tons. The Minnesota Steamship Co. is a branch of the Minnesota Iron Co., and runs in connection with the Duluth & Iron Range road.

The iron ore movement into Duluth and Two Harbors last month was 711,000 gross tons, and the total movement from Minnesota mines was about 29,000 tons additional to that amount. Of this total the Duluth, Missabe & Northern road handled 335,000 tons, not only breaking its own record and that of the port of Duluth, but also that of Minnesota. The mines of Michigan and Wisconsin are decreasing their output, and it is probable that Minnesota will this year send out more than half the iron ore shipped from the Bessemer regions of Lake Superior. Ore freight rates are less than at any time this year, and are weak. They are 20 cents less for single trips than the early contract rate for the season, something almost unprecedented, and an indication of great dullness.

The port of Duluth received 526 vessels during June and forwarded 520, with receipts and shipments of 992,891 tons of freight. This is the largest amount ever received and shipped in the history of the district.

In the past 43 days 1,293 vessels used the new Canadian canal at the Sault. In one lockage five vessels were passed.

Some surprising speeds have recently been made by the fast lake craft. The new sidewheel ship City of Buffalo has made the 176 miles between Buffalo and Cleveland in 8 hours and 47 minutes, and the North Land in 8 hours and 33 minutes. The recent tests of the latter boat are said to show that she can make 24¾ miles an hour in deep water.

A Derailment Due to Hot Weather.

An unusual kind of derailment occurred on May 6, near Banarie Junction, on the West Highland Railway in the north of Scotland. The day was very hot; a thermometer two feet above the ground registered 128 deg. F. in the sun, and the accident took place shortly after midday. It was caused by the distorting of the rails, due to their unusual expansion. The driver saw the trouble ahead of him, and promptly applied brakes, but the train was not brought to a stand until all the vehicles except the engine had been derailed. The fact that the engine did not leave the track was probably due to its having a bogie truck, but the tender, with its rigid wheel base, was unable to follow the bends in the rails and so went off, dragging the other vehicles with it.

A Steel Barge.

A steel barge has just been completed by Schultz Bros., at McKees Rocks, Pa., for Mr. W. K. Cavanaugh, of St. Louis, for use in filling the low lands near that city. The barge weighs 300 tons, and is built entirely of steel; it is 40 ft. wide and over 200 ft. long. It will have pumping apparatus for taking sand from the bed of the Mississippi River, so arranged that the water and sand will be sucked up together by the pumps, the sand thus collected being deposited on the lands to be filled.

The Port of Tampico.

We find some comments by Mr. William Davis formerly Superintendent of Texas railroads, in local newspapers on the present status of the Tampico improvements of the Mexican Central. We publish the main part of Mr. Davis' remarks, as being the latest information which we have seen of the results of the deep-water improvements at Tampico.

The jetty work begins at the mouth of the Panuco River and extends a distance of two miles to the Gulf bar, giving a depth of 28 ft. of water at low mean tide. It enables any class of ocean vessels to come up to the wharves at Tampico and discharge cargoes without the expense of lighterage or transfer. The Panuco River is as wide as the Ohio, and from 50 ft. to 53 ft. deep. It is navigable for 200 miles from its mouth. Regular lines of steamers and sailing vessels ply between Tampico, New York, New Orleans and European ports. Tampico is the only inland harbor on the Mexican Gulf. Its situation renders it free from storms and protects shipping.

The Mexican Central Tampico branch connects with the main line at Aguas Calientes and extends through a good agricultural and mining district, and gives a direct connection with the city of Mexco. This road does a large freight traffic to and from Tampico, 12 to 18 trains per day arriving and departing from the port. The Monterey & Mexican Gulf, from Monterey to Tampico, connects at Trevino with the Mexican International for Eagle Pass and San Antonio, thus giving a short line from deep water, already established to Colorado, Kansas City and St. Louis, with cheaper rates than to the northern seaboard. The Mexican Central has just completed a survey through the rich coffee and vanilla lands of the state of Vera Cruz from Tampico to the City of Mexico This line will be several miles shorter than the present route via Aguas Calientes, and will add greatly to the commerce that goes through the port of Tampico, and promises to make that city one of the leading cities on the Gulf of Mexico.

Speaking of the disadvantages under which Tampico suffers he said: "Tampico at present is at a grand disadvantage, for the want of fresh water, which is brought from the Tamasunchale River, a distance of from 10 to 15 miles. Families pay 25 cents per day for drinking-water. The Mexican Central has all the water brought down in barges from the Tamasunchale River to supply passenger engines, offices and workmen at a cost of at least $200 a day. All freight engines haul water cars a distance of forty miles to supply them. The Mexican Gulf Railway labors under the same difficulties. The poor supply of water and the present expense of procuring same decreases the net earnings. The lack of water also retards the growth of Tampico and adds to its death rate, as there is no water at present for either garden or sewage purposes."

Improving the Philadelphia Harbor.

At a conference held on June 30, at Philadelphia, between the representatives of the maritime interests of the city and the Director of the Port, the most advantageous method of expending the $500,000 appropriated for Delaware River improvements was discussed. It was determined to begin dredging at Greenwich Point and work down the river, removing the Mifflin and Holly Oak bars and Schooner ledge. All the bars are of mud, except Schooner ledge, which is of rock.

LOCOMOTIVE BUILDING.

The Erie order for 20 engines was given out this week, being divided equally between the Cooke Locomotive & Machine Co. and the Rogers Locomotive Works at Paterson on the line of the road.

CAR BUILDING.

We were misinformed in stating last week that the Grand Trunk would build several thousand new cars. The company's officers do not contemplate making any present addition to the rolling stock of the road.

The Illinois Central has 800 cars under contract for delivery in July and August These orders include 300 refrigerators awarded to the United States Car Co., and 500 coal cars, 250 of which are being built by the Wells & French Co., and 250 by the Pullman Car Co.

BRIDGE BUILDING.

Brooklyn.—The Joint Committee on Bridges of Kings and Queens counties has advertized for designs for the superstructure of a new bridge over Newtown Creek between Manhattan avenue, this city, and Vernon avenue, in Long Island City, to replace the one recently wrecked. The designs and bids will be received at the common council chamber, this city, on July 23. Compensation will only be paid to the bridge engineer whose plan is approved.

A sub-committee of the Joint Bridge Committee has passed a resolution to have the damaged draw bridge repaired at once, at a cost not to exceed $1,500.

Buffalo, N. Y.—The Erie and the New York Central have agreed to build a viaduct over their tracks at Chicago street, at a cost of about $100,000.

Cincinnati, O.—The Board of County Commissioners has authorized the construction of a bridge on the Hines road, F. S. Krug, County Engineer.

Clinton, Mo.—The Blair line has made a proposition to the St. Clair County court to build and maintain a steel wagon and railroad bridge across the Osage River at Osceola, provided the country will contribute $10,000 toward the cost. The Blair railroad proposes to spend $50,000 in crossing the river and elevating its tracks above the shore line.

Columbus, O.—Press reports state that the County Commissioners have approved the plans for a bridge near Central College, and will soon ask for bids.

Des Moines, Ia.—The City Council has directed the Board of Public Works to advertise for bids for a bridge over the river at Fifth street. The plans by the City Engineer contemplate a structure estimated to cost $30,000, completed.

Elizabeth, N. J.—A committee of the Board of Chosen Freeholders has awarded the contracts for rebuilding the South street bridge as follows: Mason work to Thomas Sheridan, of Elizabeth, for $2,770, and iron work to W. P. Kirk, of Plainfield, for $3,900.

Fairfield, Me.—The proposition of the Boston Bridge Co. to put in a temporary bridge, which will serve until the permanent structure can be completed between Fairfield and Benton, has been accepted.

Findlay, O.—The contract for the 154-ft. bridge over Blanchard River has been awarded to the Canton (O.) Bridge Co., at its bid of $3,990. Other bids were: Brackett Bridge Co., Canton, O., $4,130; Bellefontaine (O.) Bridge and Iron Co., $4,087; Champion Bridge Co., Wilmington, O., $4,050; Indiana Bridge Co., Muncie, Ind., $4,025; King Bridge Co., Cleveland, O., $4,260; Massillon (O.) Bridge Co., $4,106; New Columbus Bridge Co., Columbus, O., $4,550; Penn Bridge Co., Beaver Falls, Pa., $4,350; Toledo (O.) Bridge Co., $4,090; Wrought Iron Bridge Co., Canton, O., $4,220; Youngstown (O.) Bridge Co., $4,420.

Hightstown, N. J.—It is reported that bids for the superstructure of a new bridge over Peddie Lake were opened June 27 as follows: Berlin Iron Bridge Co., $8,489; Dean & Westbrook, New York, $8,600; Groton (N. Y.) Bridge and Manufacturing Co., $9,110; Horseheads (N. Y.) Bridge Co., $9,240; King Bridge Co., Cleveland, O., $8,410; F. R. Long, New York, $8,500; Nelson & Buchanan, Chambersburg, Pa., $8,495; New Jersey Steel & Iron Co. Trenton, $7,900; Toledo (O.) Bridge Co., $8,432; Wrought Iron Bridge Co., Canton, O., $8,470; Youngstown (O.) Bridge Co., $8,450.

Iowa Falls, Ia.—Steps have been taken toward establishing a bridge across the Iowa River at this point. The court has signed a decree which sanctions building the bridge across some property adjoining the town and also fixes the damages.

Iron Gate, Va.—Bids are asked until July 15 on the masonry and superstructure of a bridge over the Jackson River at this place. Specifications may be had of J. E. Johnson, Jr., Longdale, Va.

Joliet, Ill.—Reports state that the Chicago Drainage Board has decided to ask for bids for two bridges over the Desplaines River, to be opened Aug. 26.

Mamaroneck, N. Y.—The contract for a new iron bridge in Weaver street has been awarded to Dean & Westbrook, New York, for $470.

Mt. Pleasant, Ia.—The Board of Supervisors of Henry County has resolved to build a new bridge over Chicauqua River. The point has not yet been determined.

Newark, N. J.—Outline plans for the proposed bridge over the Passaic River, at Jackson street, have been sent to Washington for the approval of the Secretary of War. The bridge will have a draw 225 ft. long, and a 40-ft. road-bed with a walk 7 ft. wide on each side. The total cost of the structure, including the approaches and property damages of the approaches, is estimated at $130,000.

New Bedford, Mass.—Bids are asked until July 15 for building a portion of the New Bedford and Fairhaven bridge. Wm. Sanders is Chairman of the County Commissioners.

Pittsburg, Pa.—Bids for two Schenley Park bridges were opened, June 27, by E. M. Bigelow, Director of the Department of Public Works.

Name of Bidder.	350-ft. arch span.		105-ft. arch span.
	Melan.	Steel.	Melan.
Koepen & Thatcher	$270,480		$93,937
"	276,240		96,750
"	331,875		
	Stone.		Stone.
Shultz Bridge & Iron Co.		$297,000	
" " "		263,500	
C. M. Driver		289,000	127,000
"		279,000	
Keeling & Ridge	372,175	287,562	133,493
"		283,967	
Penn Bridge Co.		298,450	
"		261,800	
King Bridge Co.		298,900	
"		241,000	
Carnegie Steel Co.		305,000	
"		276,000	
Youngstown Bridge Co.		286,000	
"		248,700	
Gianini & Verik	348,152	298,000	112,500
"		259,500	
G. T. Richards	383,000	240,000	130,000
"		232,000	
Clark Brothers	410,876		146,593
Kooch, Rinehart & Co.	359,000		119,000
Jacob Friday			132,00
C. J. McDonald	563,088		119,324
Hawley & O'Rourke			137,500
Neeld & Foley*			109,902

*Not complete. Includes price per yard.
Estimated cost: Larger, $250,000; smaller, $125,000.

The contract for the larger bridge has been given to George T. Richards for $240,000; and the contract for the smaller one to Neeld & Foley for $109,902.

The city proposes to renew the floor system and make other repairs, costing in all about $80,000, to the Point Bridge, recently bought by the city for $400,000.

A charter was issued at Harrisburg, July 7, to the Central Bridge Co., of this city, to construct a bridge across the Monongahela River from Fifth avenue and Armstrong street, McKeesport, to a point above the Pittsburgh, Virginia & Charleston, in Mifflin Township. The bridge will be two-thirds of a mile west of the Duquesne bridge and a mile and a half east of the Dravosburg bridge. The Directors are: J. O. C Campbell, D. D. Miller, Paul Freyvogle, Jas. Spencer and R. T. Kinkead.

Portland, Or.—The contract for a bridge over Powder River on the Eagle Valley and Huntington road, has been let to G. W. Ruckman, for $795.

Reading, Pa.—Bids will be awarded, July 30, for the masonry and July 31 for the superstructures of the following new county bridges: One crossing the Schuylkill, at Bern Station, at an estimated cost of $18,000; one at Dauberville, crossing Irish Creek, at a cost of $1,800; one at Hummelsford, crossing Sacony Creek, at a cost of $1,500, and the fourth at Brownsville, crossing Spring Creek, at a probable cost of $1,400.

Sorel, P. Q.—The South Shore Railway Company has just completed an iron swing bridge over the Richelieu River, having a 240-ft. draw, giving it an entrance to Sorel City.

Springfield, Vt.—The Black River Railway Co., which is to build a new line from this place to Charlestown, N. H., has placed a contract of $28,600 with the Berlin Iron Bridge Co., for an iron bridge to replace the old wooden one over the Connecticut River.

Turner's Falls, Mass.—It is said that the contract for the bridge across the Deerfield River for the Conway electric road has been given to the Berlin Iron Bridge Co. The estimated cost is $10,000 to $13,000.

Urbana, Ill.—It is stated that the County Bridge Committee awarded the following contracts for highway bridges, on June 25: Joliet (Ill.) Bridge Co., three bridges at $2,310; Attica (Ind.) Bridge Co., three bridges at $2,446; Lafayette (Ind.) Bridge Co., two bridges at $1,170; Ehler Bros., Champaign, Ill., one bridge at $1,111.

Utica, N. Y.—Copies of the plans for the proposed changes in the Genesee street bridge, providing for taking out the present plate-girder trusses, narrowing up the width to 25½ ft., and building two open lattice trusses for the same, have been received by City Surveyor Johnson, from the State Engineer.

Winston, N. C.—The Norfolk & Western will rebuild at once the iron bridge recently destroyed on the Roanoke & Southern Division between Roanoke, Va. and this place.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Annapolis, Washington & Baltimore, 2¼ per cent., payable July 1.
Boston & Providence, quarterly, 2½ per cent. guaranteed, payable July 1.
Burlington, Cedar Rapids & Northern Railway Co., of Iowa, semi-annual, 2 per cent., payable July 15.
Central Railroad Co. of New Jersey, 1¼ per cent., payable Aug. 1.
Cincinnati, Portsmouth & Virginia, 2 per cent. on the preferred stock, payable July 1.
Connecticut River, 5 per cent., payable July 1.
Cumberland Valley, quarterly, 2 per cent., payable July 1.
Denver & Rio Grande, 1 per cent. on preferred stock, payable July 15.
Detroit, Hillsdale & Southwestern, 2 per cent., payable July 5.
Manhattan Railway Co., quarterly, 1½ per cent., payable July 1.
Norwich & Worcester, 4 per cent, payable July 15.
Old Colony, quarterly, 1¾ per cent, payable July 1.
Pittsfield & North Adams, 2½ per cent., payable July 1.
Portland & Rochester, 3 per cent., payable July 15.
Portland, Saco & Portsmouth, 3 per cent, payable July 14.
St. Louis, Alton & Terre Haute, 1⅛ per cent., payable July 1.
Ware River, 3½ per cent., payable July 1.
Wrightsville & Tennille, 3 per cent. on common and preferred stock, payable July 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

California Eastern, special, company's office, Equitable Building, Denver, Col., July 24.
Delaware River Railroad & Bridge Co., special, Camden, N. J., July 17.
New York & Harlem, special, Grand Central station, New York City, July 15.
Saginaw & Western, annual, Alma, Gratiot County, Mich., July 8.
West Virginia & Pittsburgh, annual, Weston, W. Va., Aug. 11.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Street Railway Association* will hold its annual convention at St. Louis on Oct. 24 and 25.

The *Roadmasters' Association of America* will hold its next annual meeting at the Cataract Hotel, Niagara Falls, N. Y., beginning Sept. 8.

The *Traveling Engineers' Association* will hold its next annual meeting at Minneapolis, Minn., commencing Sept. 8

The *Roadmasters' Association of America* will hold its next annual convention at Niagara Falls, beginning on Sept. 8.

The *Railway Signalling Club* will meet on the second Tuesday of the months of January, March, May, September and November, in Chicago. Mr. George M. Basford, is secretary, The Rookery, Chicago.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m., except in June, July and August.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets in its rooms on the first Wednesday of each month, at 8 p. m., to hear reports, and for the reading and discussion of papers. The headquarters of the Society are at 1736–1739 Monadnock Block, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m., except during July and August.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary of the association.

The *Engineers' Club of Columbus, (O.)*, meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' and Architects' Association of Southern California* meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September

The *Engineers' Society of Western New York* meets on the first Monday of each month at the Society's rooms in the Buffalo Library.

American Society of Civil Engineers.

Ground was broken on the morning of Thursday, the 9th, for the new house of the American Society of Civil Engineers on Fifty-seventh street, New York City. There was no ceremony except that a number of those who have been active in forwarding the enterprise met for dinner in the evening.

National Association of Yard Masters.

At a meeting of yard masters in Chicago a division, called No. 1, with the foregoing title, was organized on June 28 with R. W. Justin, of the Chicago, Rock Island & Pacific, as President. It is said that this is a reorganization of an association which was started at Denver a year ago, but which has not proved satisfactory.

PERSONAL.

—Mr. L. A. Shepard, Coal Agent of the Pittsburgh & Western road at Allegheny, Pa., recently resigned that position.

—Mr. Joseph H. Craig has resigned as Auditor and Purchasing Agent of the Louisville, New Albany & Chicago road.

—Mr. W. H. Healy, for the past three years Superintendent of the terminals of the Mexican Central at Tampico, Mex., has resigned.

—Mr. George Olds, formerly General Traffic Manager of the Canadian Pacific, will be the representative of the company on the Board of Managers of the Joint Traffic Association.

—Mr. O. O. Winter, Superintendent of the Willmar Division of the Great Northern, has resigned to become General Manager of the Brainerd & Northern roads, a lumber line in Minnesota.

—Mr. F. I. Hatch, Superintendent of the Michigan division of the Vandalia road, has been appointed Chief Engineer. Mr. Gibbons, formerly Chief Engineer, has taken another position with the company.

—Mr. Eugene Spalding, of Atlanta, Manager of the Southern Iron Car Line, has been appointed a joint receiver of the Marietta & North Georgia. He represents the syndicate which bought the property at foreclosure.

—Mr. Edward Shamp, formerly connected with the Southern Pacific, at Fresno, has been appointed General Superintendent of the Maricopa & Phœnix and Salt River Valley roads in Arizona. Vice G. H. Honshell, resigned.

—Mr. George W. Hibbard, who for the past year has been acting General Passenger Agent of the Duluth, South Shore & Atlantic Road, with headquarters at Marquette, Mich., has been appointed General Passenger Agent.

—Mr. William Berdan, Secretary and Treasurer of the Cooke Locomotive & Machine Co., of Paterson, N. J., and who has been associated with the business of that company for over 31 years, has just resigned and will become Secretary of the National Association of Locomotive Builders, with offices at 26 Cortlandt street, New York City.

—Mr. John C. Sanborn, Superintendent of the Plymouth division of the Old Colony road, has been elected General Manager of the Boston Terminal Company, which is to build the new Southern Union Station in Boston. He will make a trip abroad with three civil engineers, to inspect European railroad passenger stations.

—Mr. James Donohue, for three years General Freight and Passenger Agent of the Kansas City, Pittsburgh & Gulf, has resigned, and H. C. Orr, Assistant General Passenger Agent of the Burlington route at Kansas City, has been appointed in his place. Mr. Orr has been connected with the Burlington for 20 years, 16 of which he has spent in Kansas City, His new title will be General Passenger and Ticket Agent.

—Mr. James Emerson, the inventor of the Emerson continuous steam heating system, died at his home at Willimansett, Mass., on July 6. Mr. Emerson's system was one of the earliest of the continuous steam heating systems, and was in use on the Connecticut River line 10 years ago, and all the cars on that road were ultimately equipped with it. Mr. Emerson, though chiefly known to railroad men by his steam heating device, had been an inventor for many years, and devised many useful devices, particularly improvements in water wheels.

—Sir John Pender died in London, July 7, at the age of 80. To him, more than to any other man who ever lived, the world owes the development of ocean telegraphy. From the very beginning he was associated with Cyrus Field in laying the Atlantic cable, and it was largely due to his courage and persistence and to his large means and his influence with other capitalists that a transatlantic cable was laid after repeated failures. The success of that having been insured, Sir John Pender went on to develop the colossal submarine cable system which unites England with all the other countries of the world, and he was the head of the great English system of submarine cables, which extends to India and Australia, and along the Indian Ocean from Port Natal to Zanzibar and from Zanzibar to Aden. In addition, he was Chairman of the Direct Cable Company to the United States; the Chairman of the Eastern Extension Australasia and China Telegraph Company, of the Globe Trust and Telegraph Company, of the London, River Plate and Brazil Telegraph Company, etc. He was knighted for his enterprise and success in these matters; had been a Member of Parliament for many years and had enjoyed many distinctions in his own country and throughout the civilized world.

ELECTIONS AND APPOINTMENTS.

Chicago, Paducah & Memphis.—E. J. Knickerbocker has been appointed General Freight and Passenger Agent of the road.

Great Northern.—P. P. Shelby having resigned, the office of Assistant General Traffic Manager has been abolished. W. G. Benham has been appointed Western Freight Manager, with office in Seattle, in charge of the freight traffic in Idaho, Washington, Oregon, California and British Columbia.

Kansas City, Memphis & Birmingham.—The office of Trainmaster, held by B. E. McGuirk, has been abolished. J. G. Pinkerton, Master of Transportation, has removed his office from Armory, Miss., to Birmingham. The office of Superintendent of Terminals at Memphis has been abolished and the duties of that office assumed by Superintendent Sullivan. The office of Auditor at Memphis will be abolished, and Cyrus Garnsey, Jr., now Auditor, will go to Kansas City as Assistant Comptroller.

Louisville, New Albany & Chicago.—Joseph H. Craig, Auditor and Purchasing Agent, having resigned, B. E. Taylor has been appointed Purchasing Agent, and will perform such other duties as may be assigned him by the Vice-President and General Manager. Mr. Joseph L. Doherty, Assistant Auditor, will, until further notice, have charge of the Auditing Department.

St. Louis & San Francisco.—The following is a list of the new Directors of the company, elected July 1: J. Kennedy Tod, Isaac N. Seligman, J. A. Blair, E. C. Henderson, Horace Porter and Frederick Strauss, of New York; B. P. Cheney and W. T. Hart, of Boston; Samuel C. Eastman, of Concord, N. H.; Charles S. Gleed, of Topeka; George A. Ladill, Richard C. Kerens and Daniel B. Robinson, of St. Louis. A. Douglass has been elected Secretary and Frederick Strauss Assistant Treasurer of the new company.

St. Louis, Vandalia & Terre Haute.—The following appointments have now been officially announced, though they have been previously made public: H. I. Miller, General Superintendent, with office at Terre Haute, Ind.; N. C. Deane, Superintendent of the main line division, with office at Terre Haute; F. T. Hatch, Chief Engineer and Superintendent of the Michigan division, with office at Terre Haute; E. R. Darlow, Assistant Secretary, with office at St. Louis. The offices of the following officials will hereafter be at St. Louis, in the Houser Building: J. J. Turner, Vice-President and General Manager; T. J. Golden, General Attorney; C. R. Peddle, Purchasing Agent. W. S. Roney, Auditor at Terre Haute, will have charge of stationary supplies.

Seattle & International.—This company has succeeded to the property and franchise of the Seattle, Lake Shore & Eastern, west of the Cascade Mountains. The officers of the company are as follows: John H. Bryant, President and General Manager; John B. Allen, Vice-President; H. G. Struve, Secretary; Newman Kline, Superintendent and Purchasing Agent; Harry L. Talcott, Chief Engineer; F. A. Allen, General Freight and Passenger Agent; Geo. W. Harris, Auditor, and Struve, Allen, Hughes and McMicken, Attorneys, all of Seattle, Wash.

Spokane & Seattle.—This company has succeeded to the property and franchise of the Seattle, Lake Shore & Eastern, east of Cascade Mountains. The officers of the company are as follows: Jno. H. Bryant, President and General Manager; John B. Allen, Vice-President; H. G. Struve, Secretary; Geo. W. Harris, Auditor, and Struve, Allen, Hughes and McMicken, Attorneys.

Titusville, Cambridge & Lake Erie.—At the annual meeting of the stockholders, at Titusville, July 6, the following elections were made: President, A. H. Steele, New York; Secretary, George A. Chase, Titusville: Directors, F. B. Brown, R. L. Kernochan, J. I. Brecht, W. D. Kernochan and Charles Burton, of Titusville, and C. H. Treat, New York.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Arkansas Central.—Articles of incorporation of the company were filed in Arkansas last week. It is organized to build a road in Clay County, Ark., from a point on the Iron Mountain road within five miles of the Arkansas-Missouri state line to the central part of Randolph County. The offices will be at Paragould. The capital stock is $100,000. S. B. Smith, A. M. Reynolds, W. D. Clark, W. C. Hasty and S. A. D. Eaton are the incorporators. The length of the proposed road is 50 miles.

Baltimore & Ohio.—Work has been begun on the new branch of the Pittsburgh Division, known as the "Glenwood Cut-off." It will be built between Glenwood and Laughlin Station, Pa., a distance of two miles. The new line will be double tracked, and will be used for all freight traffic and for through western trains. The cost of construction is estimated at about $1,000,000.

Central of Georgia.—The company has just completed two branch roads from the main line of its southwestern railroad to fruit orchards; one, 3.54 miles long, from a point one mile east of Fort Valley, Ga., to the Hale-Albaugh Orchard; and the other, 3.21 miles long, from Marshallville Station, Ga., to S. H. Rumph's orchard.

Chicago, Paducah & Memphis.—The final surveys are being made for a branch of this line which will be built to connect Shelbyville, Ill., with Altamont. It is expected that the new road will be in operation by Jan. 1, 1897. The Chief Engineer is N. P. Alcott, who was Chief Engineer of this company during its construction.

Elkhart & Western.—It is reported that a road which will be operated in connection with the Elkhart & Western will be built to connect Elkhart with Jackson, Mich. Surveys have already been made, and the road is to be built at once by H. A. Bucklen, of Elkhart, Ind., President of the above company.

Flint & Pere Marquette.—The company has placed orders for the rails for its Toledo extension, and expects to begin track-laying by August, and trains will be running into Toledo in September. The Ann Arbor is pushing the work on the new station, which will be ready for use by that time. When this is completed the two roads will have adequate passenger terminals as well as freight facilities.

Great Northern.—Foley Brothers & Guthrie, of St. Paul, have secured the contract to build the branch southerly from Crookstown to Halsted, Minn., referred to a few weeks ago. It will be 35 miles long, and will be built over a line recently surveyed along the eastern side of the Red River and near the stream. The contractors expect to employ about 600 men in order to have the road in condition to move this summer's crops. There will be only two bridges of any importance to build. One a span across the Sand River, and the other a high trestle across Marsh River. The branch connecting Moorhead City and Crookston is also under way. This will give the Great Northern two lines north along the Minnesota side of the Red River valley, besides that from Fargo to Grand Forks. The Glyndon-Crookston line is about 12 miles back from the river; the new one will be very near the stream, and the Fargo line is about 10 miles farther west. The distance from Moorhead north to Halsted is already covered by a line 35 miles long. The new road is built in part to compete with the steamers and barges run to carry the wheat of the river farmers in the interest of the Northern Pacific road.

Mexican Roads.—G. J. Gonzales has taken charge of the management of the projected road between Torres and Minas Prietas, Mex., and construction work will begin shortly. The survey is completed and much material has been delivered at Torres.

Minnesota & Wisconsin.—This road, extending to Spring Valley, Wis., 22 miles, was bid in at foreclosure sale at Hudson, Wis., June 25, by a syndicate of principal creditors for about $80,000. It is the purpose of the new company to reorganize and extend the road to Durand and Morillan. The line was built largely by Ex-Senator D. M. Sabin to reach lumber, but it has been operated for general business.

New Martinsville & Clarksburg.—This company, of which Mr. T. M. Jackson, of Clarksburg, W. Va., is President, has let the contract for the road between the two towns named in the title to Contractor Bennett, of Athens County, O. The distance is 62 miles and it will give a short route to the Ohio River. The work of construction will be commenced in July. This road will also afford a Western outlet for the West Virginia Central & Pittsburgh.

New Roads.—A plan for a new road in Montana, to leave the Great Northern at a point about 20 miles west of Malta, Mont., is proposed. The route would be south, touching the Little Rocky mountains on the south side, and southward to the Missouri River and Musselshell Valley country, opening up an agricultural and grazing region that at present is not developed.

A road is soon to be built by the firm of Sisson, Crocker & Co., from Upton, Nev., to the St. Cloud River. Surveys are now being made, and rails have already been bought. Grading will be begun as soon as the surveys are far enough advanced.

Port Edwards, Centralia & Northern.—A party of surveyors under W. A. Scott, is working between Princeton and Wautoma, Wis., laying out a route for the proposed extension of that road to the former town.

Portland & Rumford Falls.—The contract for the branch road from Gilbertville, Me., to the new lumber mill, a distance of six miles, will be let at once, and it is the intention to have work begin in a few days.

Quakertown & Eastern.—This road was incorporated at Harrisburg, Pa., on July 6. The capital stock is $150,000. The road will be 15 miles long and will extend from Quakertown to Riegelsville.

Queen Anne's.—Work is progressing rapidly on this Maryland road. It is expected that the grading contract to Hillsborough, Md., will be finished in a few days. Rails have been laid from Queenstown, Md., to within two miles of Queen Anne's, and construction trains are running over this section of the road; work has also been finished from Greenwood to within seven miles of Denton.

St. Louis, Siloam & Southern.—A mortgage has been filed by this company in Arkansas, the United States Mortgage & Trust Company being named as trustee. The amount of the mortgage is $8,000,000. The road to be built as outlined is from St. Louis, through the states of Missouri and Arkansas, to the city of Fort Smith, a distance of 1,300 miles.

South Shore.—The company has just completed a bridge over the Richelieu River, which gives it an entrance into Sorel City, Que., the present eastern terminus of the road. The company now operates 45 miles of line along the south shore of the St. Lawrence River from a point south of Montreal, its trains running into the Grand Trunk station in that city. An extension of considerable length along the south shore of the St. Lawrence River to connect with the Intercolonial road at Levis, opposite Quebec, is to be commenced shortly. H. Beauchemin, of Sorel, Que., is General Manager of the road, and E. C. Wurtele is Treasurer.

Timpson & Carthage.—The builders are now putting down the track and completing the first eight miles of this road from Timpson, Tex., which will reach Russel, Tex. This work was begun in 1895, but the track-laying was commenced only a short time ago. There is now about five miles of completed track, and the rails will be laid into Russel in a week. The grading from Russel to Carthage will be commenced shortly. T. S. Garrison, of Timpson, is General Manager.

Tygarts Valley.—This company was incorporated at Beverly, W. Va., on July 3, with a capital stock of $500,000. The incorporators are W. H. Dashur and E. D. Williams, of Moore, Tucker Co., W. Va.; J. M. Craig, of Beverly, and S. Marshall Williams and Percy L. Williams, of Everett, Pa. The new road will extend from Beverly, where it will connect with the West Virginia Central & Pittsburgh, to a point near Mingo, in the same county.

Utah & California.—A map of the proposed route has been filed in the United States land office in Carson, Nev. This gives the route as from Milford, Utah, through the states to the Nevada line in Clover Valley, running through to Lincoln county, and thence into California.

Wisconsin Central.—The last rail on the new branch into Manitowoc, Wis., has been laid. It will require about 30 days to surface and ballast the new line. Probably trains will be running into Manitowoc regularly by July 20.

Electric Railroad Construction.

Baltimore, Md.—The Gwynn's Falls Railroad will be built to Lorraine Cemetery. It is now finished as far as the property of the North Avenue Land Co., near Weatheredville. It is built of 58-lb. "T" rails, laid on oak ties, with a ballast of stone.

Benton Harbor, Mich.—On June 24 the St. Joseph Council granted a 30-year franchise to the St. Joseph & Benton Harbor Electric Railway Co. for a street railroad two miles long to the town limits. Col. W. Worth Dean is President of the company.

The Benton Harbor & Eastern Electric Railway Co. has also secured the right of way for an electric road to pass through Berrien, Cass and Van Buren counties.

Boston, Mass.—The Newtonville & Watertown Street Railway Co. has asked permission to extend its line through North Beacon street, in Boston, to Union square in Allston.

Chicago.—The West Chicago and North Chicago ordinances giving the right to put an overhead electric line in every downtown street where they have a horse-car line have been recommended by the council.

The ordinance giving the Chicago City Railway Co. the right to build an overhead trolley line from State street to Western avenue and from Forty-third to Sixty-third streets has been granted.

The Calumet Electric Street Railway Co. will extend its line on Erie avenue from Ninety-third street to South Chicago avenue.

Cincinnati, O.—The Cincinnati Street Railway Co. is arranging to operate an electric car line over the route of the Walnut Hills cable road.

Dayton, O.—The Dayton Traction Co. has completed the 12 miles of electric road between Dayton and Miamisburg. The rails are 60-lb. sections and the roadbed is packed with gravel and stone under the ties. The power station, which is 80 ft. × 50 ft., is divided into two rooms by means of a fireproof wall. The two General Electric 200 kw. multipolar generators are driven by two 18 in. × 42 in. Hamilton Corliss condensing engines. The motor cars are 35 ft. long, 8 ft. wide, vestibuled at both ends and lighted with ten 10 c. p. lamps. The motor cars are each equipped with two 50 H. P. General Electric motors.

Greenbush, N. Y.—The Greenbush Heights Electric Railroad Co. has been incorporated with a capital stock of $40,000 to build an electric road from Greenbush, Rensselaer County, to East Greenbush, a distance of four miles. Among the incorporators are Wm. H. Slingerland, Jr., of Slingerland, N. Y.; John C. Unger, of East Greenbush, and George H. Welsh, of Albany.

Hoboken, N. J.—On July 2 the Jersey City, Hoboken & Rutherford Electric Railroad Co. began to lay tracks for electric cars through Second street in Hoboken. The franchise was granted about two months ago, but the property owners along the streets through which the trolley road obtained right of way carried the matter to the Supreme Court, which has decided the matter in favor of the company. The property owners so annoyed the workmen on July 3 that the police were sent to protect them.

Hoosick, N. Y.—The stockholders of the Hoosick Railway Co. have voted to increase the capital stock from $60,000 to $75,000, to provide funds for the construction of an extension from the terminus at Walloomsac to the Vermont state line. The surveys have been completed, and it is proposed to begin work as soon as the Bennington Railroad shall be ready to begin its proposed road to meet that of Hoosick Railroad.

Kingston, N. Y.—The State Railroad Commission has granted an application of the Kingston & Lake Katrine Railroad Co., which was recently incorporated with a capital stock of $100,000, permission to construct an electric road running from Kingston to Lake Katrine, a summer resort about four miles distant.

Lanark, Ont.—The Lanark County Electric Railway Co. has been organized with a capital stock of $100,000, to build an electric road from Lanark to Perth, 15 miles. Alex. Wender, of Carthage, N. Y., and Alex. H. Edwards, of Carleton Place, Ont., are interested.

Marietta, O.—The Marietta Electric Co. has been incorporated by Nelson Moore, Andrew L. Gracey, and others, of Marietta, to build an electric road.

Milburn, N. J.—The Milburn Electric Co. has been incorporated by Isaac Smith, W. C. Whittingham and others, of Milburn, to generate electricity for light, heat and power, and to construct and operate electric railroads.

Moundsville, W. Va.—Construction work has been begun for the completion of the Benwood Southern Electric road to the Moundsville camp grounds. The company expects to have cars running to the camp grounds by the middle of July.

Nevada City, Cal.—A company has been formed and a franchise secured to build an electric road between Nevada City and Grass Valley.

Niagara Falls, N. Y.—The Lewistown & Youngstown Frontier Electric Railway Co. has awarded the contract for furnishing its road with power to the Schoellkopf Electric Railway Co.

Peoria, Ill.—The Glen Oak & Prospect Heights Railway Co. has petitioned for a franchise for an electric railroad from Union Depot, Peoria, to Peoria Heights, a distance of nearly seven miles.

Pittsburgh, Pa.—The Wilkinsburg & East Pittsburgh Electric Railway Co. has been organized, with a capital stock of $150,000. Wm. M. Brinker is President and Geo. W. Black is Vice-President.

A charter was issued on June 29 to the North Side Traction Co. of Pittsburgh; capital stock, $15,000. Among the directors are G. T. Hamilton, of Englewood, and T. W. Dierker, of Pittsburgh.

Rahway, N. J.—The Rahway Electric Co. has been incorporated with a capital stock of $150,000 by C. V. Boynton, of Woodbridge, N. J., and Henry Maurer, of New York, to build electric railroads in Union County.

Rochester, N. Y.—It is proposed to build an electric road from Rochester to Penfield, a distance of 3½ miles.

Rockville, Conn.—The extension of the Hartford, Manchester and Rockville electric road from Manchester to Talcottville was opened July 1. This brings the road within five miles of Rockville and makes it one of the longest electric roads in Connecticut.

Salt Lake City, Utah.—The contract for the electrical machinery for the power-house of the Salt Lake & Ogden Railway Co., organized in March with a capital stock of $800,000, has been given to the General Electric Co. The contract calls for 5,000 H. P. by Oct. 1 and 10,000 H. P. later.

Sioux Falls, S. Dak.—The Sioux Falls Transportation Co., incorporated June 25 with a capital stock of $250,000, will build 30 miles of electric railroads in the State instead of four or five, as stated last week. Among the incorporators are: Charles F. Smith, of Boston, Mass.; J. H. Voorhees and Charles O. Bailey, of Sioux Falls.

Syracuse, N. Y.—The State Railroad Commission has refused to grant the Syracuse Rapid Transit Co. permission to build its proposed road, on the ground that the company proposes to operate a road upon streets already occupied by other companies. The company was incorporated May 21 with a capital stock of $4,000,000, and is said to be a reorganization of some of the roads in Syracuse.

Wapakoneta, O.—The Wapakoneta & Kenton Railway Co. has been incorporated with a capital stock of $100,000 to build an electric railroad between Kenton and Wapakoneta, a distance of about 30 miles. The incorporators are L. N. Blume, Jacob Haus, M. D. Shaw and C. T. Kolter.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The May statement of earnings shows the following comparisons:

	1896.	1895.	1894.
Gross earn	$2,269,910	$2,401,080	$2,375,629
Oper. exp.	1,788,583	2,012,509	2,015,743
Net earn	$481,327	$388,571	$359,886
P. c. exp. to earn	78¾	83⅞	84¾
For 11 months:			
Gross earn	$26,805,822	$26,444,869	$29,460,487
Net earn	6,500,138	6,011,337	8,525,807

Boston Terminal.—The directors of this company, which is to build the new Union station in Baltimore, have been authorized by the State Railroad Commissioners to issue $5,000,000 bonds to be invested in real estate and $1,000,000 for other purposes. At the hearing before the State Railroad Commissioners last week one of the trustees said that the final cost of the new station is expected to be about $8,000,000, and that $5,000,000 would be spent in ten days in buying real estate for the station. It has been already agreed to take 400,000 sq. ft. of the New England Railroad property at about $2,000,000, and the terminal company now has outstanding obligations of about $1,000,000. The rest of the present authorized issue will be used to purchase wharf properties.

Cape Fear & Yadkin Valley.—The United States Circuit Court for the Eastern District of North Carolina, in its recent decision in the petitions for decrees for foreclosure, directed the Master to take testimony as to the value of the several divisions of the road. The Receiver has prepared a statement of earnings and expenses for a period of five years from July 1, 1890, to June 30, 1895. The Receiver's statement shows that for the five years the "A" division has earned over 8 per cent. on its bonds, while the "B" and "C" divisions have each earned less than 2½ per cent. on the amount of their bonded debts. For the year ended June 30, 1895, "B" division did not earn its operating expenses, and the "C" division showed net earnings of only about $2,000 with which to pay about $50,000 interest on the "C" bonds.

Des Moines, Osceola & Southern.—Judge Woolson has issued an order discharging E. Mason as Receiver of this company, and approving his final report. Mr. Mason was appointed Receiver in April, 1885, and was in active charge of the road until three years ago, when it was sold to the Des Moines & Kansas City. The road is now being widened to standard gage, and is owned by the Keokuk & Western. The decree entered overrules the petition of the Receiver for a rehearing, and this ends the long litigation over the road.

Jacksonville & St. Louis.—The Jacksonville, Louisville & St. Louis, which was sold to the bondholders some time ago, has been reorganized, and will be operated under the above name. C. M. Stanton remains as General Manager of the road, which extends from Jacksonville to Mount Vernon, Ill.

Louisville & Nashville.—The May earnings were as follows for three years.

	1896.	1895.	1894.
Gross earn	$1,602,014	$1,533,364	$1,481,469
Oper. exp.	1,135,091	1,082,157	1,032,033
Net earn	$466,923	$451,207	$449,436
P. c. exp. to earn	70¾	70⅝	69¾
Net four months	$6,406,993	$6,540,303	$6,645,959

Northern Pacific.—The earnings for May are reported as follows by the Receivers:

	1896.	1895.	Inc. or dec.
	Eleven months to May 31st.		
Gross earn	18,230,784.04	16,160,622 47	I. 2,070,161.57
Oper. exp.	10,763,984.61	10,398.3 3 92	I. 365,680.69
Net earn	7,466,799 43	5,762,318.55	I. 1,704,480.88
P. c. exp. to earn	59.04	64.34	D. 5.30

The miscellaneous income is not included and taxes are not deducted.

St. Louis & San Francisco.—The Receivers transferred the property to the officers of the new company on July 1. Judge Thayer, in the United States Circuit Court at St. Louis, has made the following allowances in the receivership case: George D. Reynolds, as Special Master, $750 a month until Aug. 1 next and $15,625 for his services in connection with the sale of the road; Alexander & Green, of New York, and J. E. McKeighan, of St. Louis, solicitors and counsel for the complainant, $50,000, in addition to $15,000 previously awarded them; Receivers McCook, Walker and Wilson $12,000 a year, and George E. Peck, solicitor for the receivers, $12,500.

Terre Haute & Logansport.—The company is in default on the July, 1896, coupons on its first mortgage six per cent. bonds. The issue is only $500,000. The road is leased on a guaranty of principal and interest of its bonds to the Terre Haute & Indianapolis, a controlling interest in the stock of which company was bought by the Pennsylvania Railroad Company in 1893.

Toledo, Peoria & Western.—The annual report for the year ending Dec. 31, 1895, shows that the tonnage was 723,691 tons against 621,474 tons in 1894, an increase of 102,217 tons, or 16.45 per cent. entirely in through traffic. The largest items of increase were grain, miscellaneous mill and animal products, anthracite coal, petroleum, sugar and miscellaneous manufactures. There were large decreases in bituminous coal, stone, sand and miscellaneous merchandise. The work of replacing trestles and wooden bridges with embankment and iron structures was further continued, as also the ballasting of the track with cinder and gravel. Four consolidated engines and 250 box cars were purchased. The average rate per ton per mile was 1.19 cents, against 1.32 cents in 1864. Earnings and expenses follow:

Earnings—	1895.	1894.
Freight	$611,893	$542,369
Passengers	293,011	271,954
Mail, express, rents, etc	86,362	79,297
Total	$991,265	$893,620
Expenses—		
Maintenance of way	$220,793	$165,805
Maintenance of equipment	76,593	75,357
Conducting transportation	442,207	433,719
General	30,300	30,214
Taxes	38,782	36,848
Total	$808,675	$741,943
Net earnings	182,594	151,678
Deduct—		
Interest on bonds	$195,800	$195,800
Interest on floating debt	11,535	1,979
Betterments	.....	16,455
Total	$207,335	$214,234
Balance, loss	4,741	62,554

Electric Railroad News.

Augusta, Ga.—A charter has been granted to the Augusta Street Railway & Electric Co., which purchased the street line at Augusta recently. The capital stock is $500,000.

Cincinnati, O.—At the annual meeting of the stockholders of the Cincinnati Street Railway Co., to be held July 29, the question of purchasing the lines of the Mt. Adams & Eden Park Inclined Railway Co., which has a capital stock of $2,500,000, will be considered, as well as the purchase of the Mt. Auburn Cable road. As proposed, to increase of the capital stocks from $11,000,000 to $18,000,000 will also be voted on.

Chattanooga, Tenn.—The Chattanooga & Northside Street Railway Co. has been sold at public auction for $8,100. On Jan. 18, 1896, a Receiver was appointed on foreclosure proceedings instituted by the bondholders. The capital stock was $40,000.

Clarksville, Tenn.—The property and franchises of the Clarksville Street Railway Co. have been sold for $2,000. The capital stock of the road was $100,000. It was being equipped with electricity at the time of the sale.

Cohoes, N. Y.—The Albany City Railway Co. and the Cohoes City electric railway companies have been consolidated. John W. McNamara has been elected President; John Garside, Secretary, and Edgar S. Fassett, Treasurer. Among the Directors are Thomas I. Van Antwerp, Albert Hersberg and George R. Turner.

TRAFFIC.

Traffic Notes.

The Canadian Pacific has joined the Joint Traffic Association for a period of six months, but with some sort of a reservation that it may withdraw upon 30 days' notice if it is not satisfied with the share of traffic it gets.

The Board of Managers of the Joint Traffic Association have adopted a resolution that after Aug. 31 all commissions on import freight at Atlantic ports be abolished, except 15 per cent. on the first three classes and 10 per cent. on the three lower classes, to regular agents, one agent for each initial company at each port. No commissions are to be allowed on earnings west of Chicago and the Mississippi River or south of the Ohio, and none at all on freight charged at less than sixth-class rates, nor upon tin plate or green fruit. The resolution also contains other regulations exceedingly strict, intended to keep commission payments with narrow limits.

The Interstate Commerce Commission.

The Interstate Commerce Commission, in an opinion by Commissioner Knapp, has announced its decision of two cases brought by the Lynchburg Board of Trade against the Old Dominion and the Merchants' and Miners' steamship companies and the Norfolk & Western, and the East Tennessee, Virginia & Georgia railroads. The Commission rules that a carrier is not justified in charging more for the shorter than for the longer distance by competition at the longer distance point of other carriers which are themselves subject to that act, in the absence of authority from the Commission under the proviso clause of the fourth section. When rates are relatively unjust so that undue preference is afforded to one locality or undue prejudice results to another, the law is violated and its penalties incurred, although the higher rate is not in itself excessive, and such rule is especially applicable where a given relation in rates, long continued and concededly equitable, is suddenly and almost completely reversed, merely because other carriers to the longer distance point have disregarded their legal duties. During the period between May 29 and Aug. 1, 1894, when greatly reduced rates were charged by defendants to Knoxville, Tenn., dealers at Lynchburg, Va., an intermediate locality, were entitled to rates over the defendant lines from New York, Providence and Boston not greater than those accepted at the same time on like traffic over said lines to Knoxville, and the excess paid for transportation by the intervening Lynchburg dealers over contemporaneous rates to Knoxville was unlawfully collected. Reparation is ordered accordingly.

Chicago Traffic Matters.

CHICAGO, July 8, 1896.

The Western roads have given up all hope of receiving any assistance from the Joint Traffic lines in meeting Soo competition on wool, and the Burlington has made a rate from Billings, Mont., which, added to the rates now in effect east of Chicago, will just meet those of the Northern Pacific and the Soo through to New York and Boston. This is too late to capture much of the business, but it is estimated that it will bring 85 cars via Chicago, all to go east by the Lake Shore.

C. C. Morrison, a Milwaukee Vice-President of the League of American Wheelmen, has written a letter to Chairman Caldwell, of the Western Passenger Association, in which he says that the League will fight the bicycle charge of the railroads if the same is not soon abolished.

The roads of the Central Passenger Committee, at a meeting in Chicago this week, will consider a proposed amendment to the rules of the committee providing that all special reduced rates be in the future confined strictly to the persons for whose benefit they are made; that when such rates are agreed to for conventions, meetings, etc., no advertisement of them shall be made to the public and that delegates only be informed. It is not believed that the proposed amendment will pass, as a majority of the members are at present opposed to it.

The Wabash has put on a new day passenger train, between Chicago and Detroit. The train leaves this city daily, except Sunday, at 9:50 a. m., arriving in Detroit at 6:30 p. m. Returning, leaves Detroit at 8:20 a. m., arriving in Chicago at 4:55 p m.

The Wisconsin Central and the Monon have constructed specially arranged bicycle baggage cars. The cars of both lines are similar in construction, having a horizontal partition running through them midway between the floor and the roof, the lower part being used for trunks and baggage and the upper part being fitted with grooves and fastenings for bicycles.

One by one the Chicago suburban lines are being forced to reduce their rates to meet the increasing electric and elevated competition. This competition is not confined to any one territory around the city, but is general. During the past year the Illinois Central has made two reductions in its suburban rates, the Rock Island has made two and the Chicago and Northern Pacific has made three. The Lake Shore & Michigan Southern, which maintains an extensive suburban service, has clung to its old rates, but this road has at last been forced to meet the conditions, and has now announced a general reduction in its rates between Whitings, Ind., and all intermediate stations and Van Buren street station. The one-way rate from Whitings, 16 miles, to Van Buren street, is reduced from 50 to 20 cents., the round trip rate from 60 to 40 cents and 54-ride monthly tickets, from $9.50 to $5.40. Corresponding reductions are made from the Boulevard, South Chicago and stock yard districts, the cuts in some cases amounting to 50 per cent.

The following tables show the receipts and shipments of live stock at the Union Stock Yards, Chicago, with the number of carloads carried by each road during the month of June:

RECEIPTS.

Roads.	1896.	1895
Atchison, Topeka & Santa Fe	5.278	5,825
Chicago & Alton	8,788	8 515
Burlington	3,792	28,843
Chicago, Milwaukee & St. Paul	21,341	18,371
Chicago & Northwestern	26,950	22,663
Chicago, Rock Island & Pacific	13,902	13,671
Chicago Great Western	4.579	3 571
Illinois Central	12.238	12.592
Wabash	5,725	7,672
Other lines	6,074	6 560
Totals	138,667	128,289
Increase	10,378	

SHIPMENTS.

Roads.	1896.	1895.
Baltimore & Ohio	1,931	1,776
Erie	6,524	5,452
Chicago & Grand Trunk	11,965	8,448
Lake Shore & Michigan Southern	5,219	5,889
Michigan Central	3,664	3,878
New York, Chicago & St. Louis	1,726	743
Pittsburgh, Cincinnati, Chicago & St. Louis	211	454
Pittsburgh, Fort Wayne & Chicago	4,327	4,968
Other lines	3,460	3,514
Total	39,027	35.112
Increase	3,915	

The Western roads are again in trouble over grain rates. Two of the Chicago-Missouri River roads recently reissued their old through proportional grain tariffs via Chicago. To meet these the Chicago Great Western has now put in reduced flat grain rates from the Missouri River to this city. These tariffs reduce the grain rates from Kansas City to Chicago from 20 to 16 cents per 100 lbs.

Total shipments from Chicago to the East last week by lake amounted to 51,918 tons, of which 47,603 tons were grain. Total all-rail shipments East, exclusive of live stock, amounted to 46,605 tons, compared with 56,782 tons for the preceding week, a decrease of 10,177 tons, and against 58,977 tons for the corresponding week of last year. The big decrease last week is accounted for by the fact that the statement is for only five days. The proportions carried by each road were as follows:

Roads.	WEEK TO JULY 4.		WEEK TO JUNE 27.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	4,647	10.0	5,783	10.2
Wabash	5,240	11.3	6,679	11.8
Lake Shore & Mich. South.	5,351	11.4	7,542	13.3
Pitts., Ft. Wayne & Chicago	6,557	14.5	6,010	10 6
Pitts., Cin., Chi. & St. Louis	5,468	11.7	5,759	10.1
Baltimore & Ohio	4,123	8.9	5,051	8.9
Chicago & Grand Trunk	4,764	10.2	6,312	11.1
New York, Chi. & St. Louis	3,907	8.4	5,813	10.2
Erie	4,263	10.4	6,609	11 6
C., C., C. & St. Louis	1,486	3.2	1,224	2.2
Totals	46,605	100.0	56,782	100.0

Of the above shipments 2,051 tons were flour, 18,958 tons grain, 8,723 tons provisions, 7,234 tons dressed beef, 2,751 tons butter, 989 tons hides, and 4.483 tons lumber.